California Regional Water Quality Control Board
Santa Ana Region

DRAFT
Problem Statement
For the
Total Maximum Daily Load
For Toxic Substances
In Newport Bay and San Diego Creek

August 25, 2000 Draft

Note to Reader:

This is a working draft of the problem statement for the Total Maximum Daily Load (TMDL) for toxic substances in Newport Bay and San Diego Creek, Orange County, California, and therefore the report is subject to change based on further analyses and input from interested parties.

The purpose of this problem statement is to review the available scientific data regarding toxic substances in Newport Bay and San Diego Creek to determine which substances must be addressed by a Total Maximum Daily Load (TMDL). The TMDL must assure that water quality standards in these two waterbodies are achieved, i.e., that applicable numeric and narrative water quality objectives for toxic substances are achieved, and that beneficial uses are protected. Toxic substances that cause or contribute to a violation of water quality objectives and/or that result in adverse effects on beneficial uses must be addressed by a TMDL.

Regional Board staff requests that interested watershed stakeholders review this draft problem statement and provide comments and recommendations. The stakeholders are also requested to submit any additional evidence they wish to be considered by the Board in the completion of the problem statement.

Staff will carefully consider the comments received and revise the problem statement as appropriate. The final problem statement will be presented to the Regional Board for their consideration and approval, during a public workshop.

Table of Contents

Section 1 Summary of the Problem Statement for the TMDL for Toxic Substances in Newport Bay and San Diego Creek

Pursuant to the requirements of Section 303(d) of the Clean Water Act (CWA), in the late 1980's and early 1990's, the Regional Board listed Newport Bay and San Diego Creek as impaired due, in part, to violations, or threatened violations of the Basin Plan narrative objectives for toxic substances. (CRWQCB, Santa Ana Region, Section 303(d) List, 1990) These listings were based on evidence of the relatively high bioaccumulation of lead, DDT, PCB's and other toxic substances in mussel and fish tissue collected from the Bay and Creek. These data were provided by the State Water Resource Control Board's State Mussel Watch (SMW) and Toxic Substances Monitoring (TSM) Programs.

SMW and TSM are statewide programs designed to provide data on the spatial and temporal distribution of toxic substances in California's surface waters. The data are intended to be used to identify the need for additional focused monitoring in apparent problem areas. In general, the data are not statistically sufficient to support fish or shellfish consumption advisories to protect public health, (Bob Brodberg, OEHHA, personal communication April 2000) or to make definitive conclusions regarding the impacts of toxic substances on aquatic or other biota in Newport Bay and San Diego Creek. Therefore, in placing Newport Bay and San Diego Creek on the Section 303(d) list, the Board did not specifically identify those toxic substances to be addressed by a TMDL.

The Regional Board and the State Water Resources Control Board completed additional studies to evaluate the nature and impact of toxic substance discharges on Newport Bay and San Diego Creek. This more recent evidence confirms the Regional Board's listing decision, and serves as the basis for refinement of the Section 303(d) list to identify those pollutants that are known (or suspected) to be causing violations of water quality standards, and that therefore must be addressed by a TMDL.

The Basin Plan specifies two narrative water quality objectives for toxic substances. These are that (1) toxic substances shall not be discharged at levels that will bioaccumulate in aquatic resources to levels which are harmful to human health, and (2) the concentration of toxic substances in the water column, sediment or biota shall not adversely affect beneficial uses. Evidence of acute and chronic toxicity to aquatic organisms as the result of toxic substances in the water column and sediment indicates that the second objective is being violated in San Diego Creek and Upper and Lower Newport Bay. The bioaccumulation data provided by the SMW and TSM programs remains insufficient to judge whether a public threat is posed by the consumption of fish or shellfish collected from the Bay or San Diego Creek. However, the evidence does indicate that some toxic substances are bioaccumulating in fish and mussel tissue at levels that, if confirmed by statistically significant tissue monitoring, would pose a threat to human consumers. Thus, there is evidence that the first objective is being, or is threatened to be, violated. Further, the bioaccumulation data provided by the TSM program indicate that the concentrations of certain toxic substances in fish in San Diego Creek may adversely affect the biota, which would constitute violations of the second objective.

The U.S. EPA recently promulgated numeric water quality objectives for 126 toxic substances for California's inland surface and bay and estuarine waters. (California Toxics Rule, May 18, 2000) The CTR criteria automatically become a part of the Basin Plan water quality objectives. Water column monitoring data indicates violations of the CTR chronic criteria for selenium in San Diego Creek.

This report summarizes the data reviewed to evaluate violations and threatened violations of the Basin Plan narrative and numeric water quality objectives for toxic substances in Newport Bay and its tributaries and the results of that assessment. In summary, five categories of toxic substance related problems have been identified for San Diego Creek and Newport Bay:

1. Evidence of water column acute and chronic toxicity to aquatic life in San Diego Creek and Newport Bay, indicating a condition of violations of the second Basin Plan narrative objective for toxic substances. The extent of water column toxicity in Newport Bay is not well defined and varies with fresh water flow discharges. In San Diego Creek at Campus Drive approximately 1.0 Acute Toxicity Units (TUa) have been measured during base flow conditions and up to 10 TUa during periods with rain runoff. A Toxicity Identification Evaluation (TIE) shows that the aquatic life toxicity in San Diego Creek is caused by diazinon and chlorpyrifos, and unknown toxic substances. There is also evidence of toxicity found in the tributaries to San Diego Creek. Concentrations of dissolved cadmium, chromium, copper, lead, nickel, silver, and zinc in San Diego Creek at Campus Drive do not exceed the criteria for these toxic substances established by USEPA in the California Toxics Rule, which indicates these chemicals are probably not causing, or contributing to, toxicity to aquatic life. This is supported by TIE evidence. However, average concentrations of dissolved selenium in San Diego Creek at Campus exceed the 4-day average chronic effects CTR criteria. There is some evidence of water column toxicity due to chlorpyrifos in Upper Newport Bay, as well as toxicity due to unknown causes. Diazinon does not appear to be causing toxicity in Newport Bay.

2. Evidence of acute and chronic toxicity to aquatic life in the sediment, and the porewater of the sediment, in Upper and Lower Newport Bay, indicating a violation of the second Basin Plan narrative objective for toxic substances. The cause of this toxicity is unknown, but a statistical correlation was found between sediment toxicity/sediment pore water toxicity to amphipods and sea

urchin larvae, and Percent Fines, Total Organic Carbon, Antimony, Chromium, Copper, Lead, Mercury, Nickel, Tin, Zinc, Chlordane, and PCBs. There is also a correlation between degraded benthic organisms and Chromium, Copper, Iron, Nickel, DDE, and Percent Fines. The toxicity to aquatic life in the sediment may cause or contribute to the toxicity measured in the water column and the degradation of benthic organisms observed in some areas of the Bay, and therefore indicate violations of the second narrative objective for toxic substances.

3. Evidence of bioaccumulation of certain heavy metals, PCBs, tributyltin, DDT in mussel tissue in the Rhine Channel area, at the west end of Lower Newport Bay. (The Regional Board has already identified the Rhine Channel as a Toxic Hot Spot for priority action.)

4. Evidence of continued, but declining, bioaccumulation of chemicals no longer in use, including DDT, chlordane, dieldrin, and PCBs, in mussel and clam tissue from samples collected throughout the Bay and lower San Diego Creek.

5. Questions about evidence for toxic substances found in various monitoring programs to be exceeding USEPA or other recommended water, sediment, and tissue concentration quality criteria. Data, and /or criteria, for these substances are inadequate to determine whether and to what extent there is a violation of the narrative objectives for toxic substances or an impact to beneficial uses caused by the chemical.

This problem statement, and the toxic substance water quality problems identified below, serve to refine the Section 303(d) list for Newport Bay and San Diego Creek and will be used as the basis for the completion of the TMDL for toxic substances in these two water bodies. The Regional Board will also be asked to approve the Problem Statement to specifically identify the toxic substances related water quality problems and the work plan for the development of the TMDL for the identified problems and toxic substances.

Section 2 The Newport Bay Watershed

The Newport Bay watershed is located in central Orange County, California (Figure 1). (OCPFRD, Flood Channel Map, 1998) The watershed encompasses 154 square miles and includes portions of the Cities of Newport Beach, Irvine, Laguna Hills, Lake Forest, Tustin, Orange, Santa Ana, and Costa Mesa. The watershed is encircled by mountains on three sides: the Santa Ana Mountains to the north, the Santiago Hills to the northeast, and the San Joaquin Hills to the south. The runoff from these mountains drains across the Tustin Plain and enters Newport Bay via Peters Canyon Wash and San Diego Creek. The San

Diego Creek watershed, which encompasses Peters Canyon Wash, is 105 square miles in area. The other 49 square miles of drainage that enter Newport Bay include the Santa Ana-Delhi Channel, Bonita Creek, Big Canyon Wash, and a large number of smaller tributaries which drain to the Lower Newport Bay. Newport Bay is a long, enclosed estuary roughly divided into the Upper and Lower Bay areas by the Pacific Coast Highway Bridge. The entire Bay up to the mouth of San Diego Creek is subject to tidal influence.

The nature of the Newport Bay watershed has changed dramatically over the last 150 years, both in terms of land use and drainage patterns. In the late 19th and early 20th centuries, land use changed from ranching and grazing to farming. Following World War II, land use again began to change, from farming to residential and commercial development. In 1983, agriculture accounted for 22% and urban uses for 48% of the area of the Newport Bay watershed (OCPFRD, 1998). In 1993, agricultural uses accounted for 12% and urban uses for over 64% of the area. Table 1 summarizes the land use and area of the two largest subwatersheds, San Diego Creek and Santa Ana-Delhi. Agricultural activities in the watershed include row crops (primarily strawberries), avocados, lemons, and commercial nurseries. Urban development in the area consists of residential, commercial, and light industrial land uses.

Significant drainage modifications were made in the watershed to accommodate these changes in land use (Figure 2). (Trimble, 1987) In the mid-19th century, the Santa Ana River flowed into Newport Bay, while San Diego Creek and the small tributaries from the Santiago Hills drained into an ephemeral lake and the Swamp of the Frogs and then into the River. To make room for farming, the ephemeral lake and Swamp of the Frogs were drained and the vegetation was cleared. Channels that did not always follow natural drainage patterns were constructed to convey runoff to San Diego Creek and then Newport Bay. In the early 20th century, a major flood event on the Santa Ana River caused a significant amount of sediment to be deposited into the Lower Bay, and the local community dug a channel for the River to bypass the Bay and discharge directly to the Pacific Ocean. In 1920, the River was permanently diverted into the current flood control channel that discharges to the ocean. As urban development in the watershed proceeded (and proceeds), the drainages were further modified to expand their capacity in order to provide flood protection to the structures being built. These changes to the drainage patterns in the San Diego Creek Watershed culminated in the channelization of San Diego Creek in the early 1960s by the Orange County Flood Control Department. The channelization isolated the San Joaquin Marsh, the last remaining portions of the historic marsh upstream of Upper Newport Bay, from San Diego Creek.

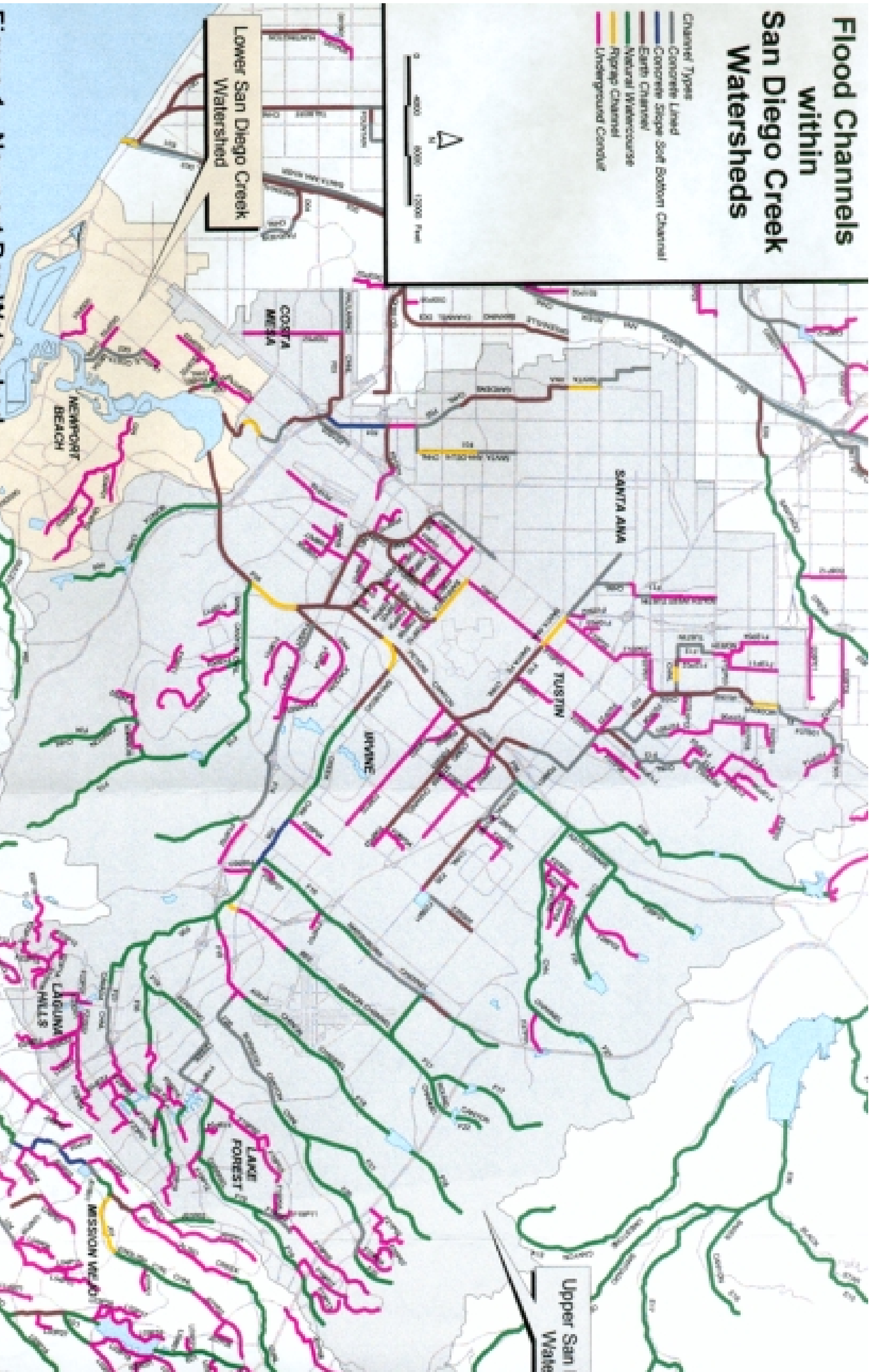

Figure 1: Newport Bay Watershed

Table 1: Summary of Land Use in the San Diego Creek and Santa Ana Delhi Watersheds (OCPFRD, 1998)

Land Use	San Diego Creek	San Diego Creek		Santa Ana Delhi	Santa Ana Delhi	
	Sq. Mi.	% of watershed		Sq. Mi.	% of watershed	
Residential	17.9	15		5.6	33	
Commercial	9.5	8		2.9	17	
Industrial	7.5	6.3		1.4	8	
Open Space	27.5	23.1		1	5.6	
Agricultural	11.9	10		0.3	1.5	
Public	0.4	0.3		0.2	1.2	
Recreation	0.4	0.3		0.2	1.3	
Transportation Utilities	1.4	1.2		0.5	3	
Roads	42.6	35.8		5.2	30.4	

These land use and drainage modifications have affected the nature and magnitude of toxic substance discharges to the Bay. Changing land use introduced new sources of toxic substances, while the drainage of historic marshes and wetlands reduced the toxic substances removal benefits such habitats can provide. The change of land use from grazing type agriculture to orchards and row crops has increased the amount of pesticide use in the watershed, resulting in discharges of pesticides from these areas. However, it is important to note that since the data from Table 1 was collected there has been a continual conversion of agricultural land to urban development, which has resulted in pesticide discharges in runoff from the structural and landscape control of pests. Currently, agricultural land in the watershed is less that 7,500 acres, which are approximately 7% of the land area, as compared to 12% in 1998. (Christina Smith, UCCE, Personal Communication, March, 2000)

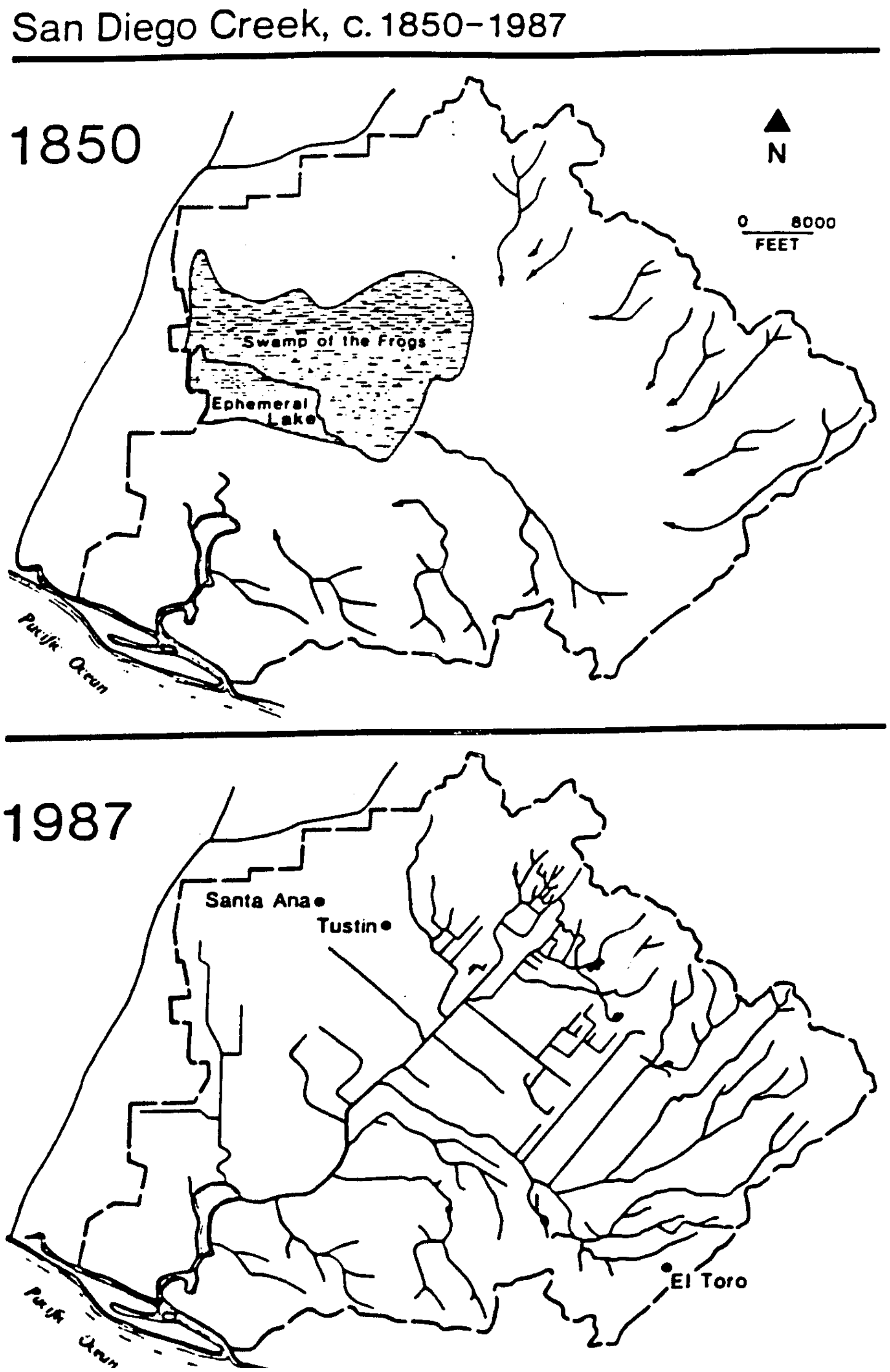

Figure 2: **Comparative Differences in Drainage Patterns over 137 Years in the Newport Bay/San Diego Creek Watershed (Trimble, 1987)**

Major portions of San Diego Creek and the other tributaries are basically flood control channels with flows consisting largely of urban runoff. During the dry season, the flow volumes in San Diego Creek and the other tributaries to the Bay are generally low, 7 to 10 cubic feet per second, comprised of urban runoff and surfacing groundwater, and are insufficient for most swimming. Water contact recreation would be limited to wading and swimming by children. During rain events, when the flow volumes increase, the flow velocity makes it unsafe for swimming. The Orange County Flood Control District has restricted public access to many of the drainages to Newport Bay because of the unsafe conditions during storm events. Due to channelization and bank stabilization, major portions of San Diego Creek and its tributaries contain only limited and intermittent aquatic life resources. Upstream of the 405 freeway the Creek and the tributaries have very little riparian vegetation and aquatic resources are limited to minnows and small fish that are not fished for human consumption. Downstream of the 405 freeway the San Diego Creek channel was constructed in the late 1960's and includes sufficient volume for flood control and to maintain a strip of riparian vegetation. This reach of the Creek also contains three sediment control basins that provide pond areas for carp and other fish. This lower reach therefore has more valuable aquatic resources.

The watershed has a Mediterranean type climate characterized by short, mild wet winters and hot dry summers. There are two types of rainstorms in this region: most are related to the extra tropical cyclones of winter, and the others are infrequent summer thunderstorms. Both types of storms produce intense rainfall. According to the Orange County Environmental Management Agency, the 40-year average annual rainfall recorded at Tustin-Irvine Ranch Station was calculated to be 12.67 inches, of which 90% occurs between November and April. (OCPFRD, Rainfall Data for Orange County, 1998)

Section 2.1 Beneficial Uses and Water Quality Objectives

The 1995 Water Quality Control Plan for the Santa Ana River Basin (Basin Plan) establishes water quality standards for Newport Bay and San Diego Creek. (CRWQCB, Santa Ana Region, Basin Plan, 1995) These water quality standards include the designated beneficial uses of these water bodies and the water quality objectives for the protection of these beneficial uses. The beneficial uses of San Diego Creek and Newport Bay as identified in the (Basin Plan) are listed in Table 2.

The Basin Plan also contains two applicable narrative water quality objectives for enclosed bays and estuaries and inland surface waters that relate to toxic substances impairment in Newport Bay and San Diego Creek:

> Toxic Substances
>
> Toxic substances shall not be discharged at levels that will bioaccumulate in aquatic resources to levels, which are harmful to human health.

and

> The concentration of toxic substances in the water column, sediments or biota shall not adversely affect beneficial uses.

US EPA promulgated numeric water quality criteria for priority toxic substances for enclosed bays and estuaries and inland surface waters of the State of California, including Newport Bay and San Diego Creek, on May 18, 2000 (California Toxics Rule (CTR), Federal Register, May 18, 2000). The State Water Resources Control Board adopted an implementation plan for these promulgated objectives on March 2, 2000. (SWRCB, Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California, March 2, 2000) The CTR numeric water quality criteria are shown in Table 3 below. The list includes criteria for the protection of aquatic life in the form of a Constituent Maximum Concentration (CMC) and a Constituent Chronic Concentration (CCC). These are instantaneous maximum and 4 day average concentrations for the protection of aquatic life from acute and chronic effects, respectively. Also listed are the water quality objectives for the protection of human health from the consumption of fish and organisms.

Table 2. Beneficial Uses of San Diego Creek, Tributaries, and Newport Bay

<table>
<tr><th></th><th>GWR</th><th>NAV</th><th>REC1</th><th>REC2</th><th>COMM</th><th>WARM</th><th>BIOL</th><th>WILD</th><th>RARE</th><th>SPWN</th><th>MAR</th><th>SHEL</th><th>EST</th></tr>
<tr><td>San Diego Creek, Reach 1[b]</td><td></td><td></td><td>X</td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>San Diego Creek, Reach 2</td><td>|</td><td></td><td>|</td><td>|</td><td></td><td>|</td><td></td><td>|</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Tributaries to San Diego Creek [C]</td><td>|</td><td></td><td>|</td><td>|</td><td></td><td>|</td><td></td><td>|</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Upper Newport Bay</td><td></td><td></td><td>X</td><td>X</td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>Lower Newport Bay</td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr>
</table>

[a] X denotes a present or potential beneficial use, | denotes an intermittent beneficial use.
[b] Reach 1 is from Jeffrey Road to Newport Bay, Reach 2 is from Jeffrey Road to the headwaters.
[C] Sand Canyon has a **RARE** beneficial use.

Beneficial Uses:

Groundwater Recharge (**GWR**)
Navigation (**NAV**)
Water Contact Recreation (**REC1**)
Non-contact Water Recreation (**REC2**)
Commercial and Sportfishing (**COMM**)
Preservation of Biological Habitats of Special Significance (**BIOL**)
Spawning, Reproduction, and Development (**SPWN**)
Wildlife Habitat (**WILD**)
Estuarine Habitat (**EST**)
Shellfish Harvesting (**SHEL**)
Marine Habitat (**MAR**)
Warm Freshwater Habitat (**WARM**)
Rare, Threatened or Endangered Species (**RARE**)

Table 3: California Toxic Rule Water Quality Criteria for Toxic Substances

	Compound	Fresh Water		Consumption of	Salt Water	
		CMC	CCC	Organisms	CMC	CCC
		ppb	ppb	ppb	ppb	ppb
1	Antimony			4300		
2	Arsenic	340	150		69	36
3	Beryllium	Narrative Objectives for Toxic Substances				
4	Cadmium	21.6	7.31		42	9.3
5a	Chromium III	5405	644.2			
5b	Chromium VI	16	11		1100	50
6	Copper	51.7	30.5		4.8	3.1
7	Lead	477	39.22		210	8.5
8	Mercury	1.4	0.77	0.051	1.8	0.94
9	Nickel	1516	168.54	4600	74	8.2
10	Selenium		5		290	71
11	Silver	44.1			1.9	
12	Thallium			6.3		
13	Zinc	388	387.83		90	81
14	Cyanide	22	5.2	220,000	1	1
15	Asbestos					
16	2,3,7,8 TCDD			0.000000014		
17	Acrolein			780		
18	Acrylonitrile			0.66		
19	Benzene			71		
20	Bromoform			360		
21	Carbon Tetrachloride			4.4		
22	Chlorobenzene			21,000		
23	Chlorodibromomethane			34		
24	Chlorethane					
25	2-Chrlorethylvinyl Ether					
26	Chloroform			470		
27	Dichlorobromomethane			46		
28	1,1-Dichloroethane					
29	1,2-Dichloroethane			99		
30	1,1-Dichloroethylene			3.2		
31	1,2-Dichloropropane			39		
32	1,3-Dichloropropylene			1700		

Table 3: California Toxic Rule Water Quality Criteria for Toxic Substances

	Compound	Fresh Water		Consumption of	Salt Water	
		CMC	CCC	Organisms	CMC	CCC
		Ppb	ppb	ppb	ppb	ppb
33	Ethylbenzene			29,000		
34	Methyl Bromide			4,000		
35	Methyl Chloride	Narrative Objectives for Toxic Substances				
36	Methylene Chloride			1,600		
37	1,1,2,2-Tetrachloroethane			11		
38	Tetrachloroethylene			8.85		
39	Toluene			200,000		
40	1,2-Trans-Dichloroethylene			140,000		
41	1,1,1-Trichloroethane	Narrative Objectives for Toxic Substances				
42	1,1,2-Trichloroethane			42		
43	Trichloroethylene			81		
44	Vinyl Chloride			525		
45	2-Chlrophenol			400		
46	2,4-Dichlorophenol			790		
47	2,4-Dimethylphenol			2300		
48	2-Methyl-4,6-Dinitrophenol			765		
49	2,4-Dinitrophenol			14,000		
50	2-Nitrophenol					
51	4-Nitrophenol					
52	3-Methyl-4-Chlorophenol					
53	Pentachlorophenol	19	15	8.2	13	7.9
54	Phenol			4,600,000		
55	2,4,6-Trichlorophenol			6.5		
56	Acenaphthene			2,700		
57	Acenaphthylene					
58	Anthracene			110,000		
59	Benzidine			0.00054		
60	Benzo(a)Anthracene			0.049		
61	Benzo(a)Pyrene			0.049		
62	Benzo(b)Fluoranthene			0.049		
63	Benzo(ghi)Perylene					
64	Benzo(k)Fluoranthene			0.049		
65	Bis(2-Chloroethoxy)Methane					
66	Bis(2-Chloroethyl)Ether			1.4		
67	Bis(2-Chloroisopropyl)Ether			170,000		
68	Bis(2-Ethylhexyl)Phthalate			5.9		

Table 3: California Toxic Rule Water Quality Criteria for Toxic Substances						
	Compound	**Fresh Water**		**Consumption of**	**Salt Water**	
		CMC	**CCC**	**Organisms**	**CMC**	**CCC**
		Ppb	**ppb**	**ppb**	**ppb**	**ppb**
69	4-Bromophenyl Phenyl Ether					
70	Butylbenzyl Phthalate			5200		
71	2-Chloronaphthalene			4,300		
72	4-Chlorophenyl Phenyl Ether					
73	Chrysene			0.049		
74	Bibenzo(a,h)Anthracene					0.049
75	1,2 Dichlorobenzene			17,000		
76	1,3 Dichlorobenzene			2,600		
77	1,4 Dichlorobenzene			2,600		
78	3,3 Dichlorobenzidine			0.077		
79	Diethyl Phthalate			120,000		
80	Dimethyl Phthalate			2,900,000		
81	Di-n-Butyl Phthalate			12,000		
82	2,4-Dinitrotoluene			9.1		
83	2,6-Dinitrotoluene					
84	Di-n-Octyl Phthalate					
85	1,2-Diphenylhydrazine			0.54		
86	Fluoranthene			370		
87	Fluorene			14,000		
88	Hexachlorobenzene			0.00077		
89	Hexachlorobutadiene			50		
90	Hexachlorocyclopentadiene					17,000
91	Hexachloroethane			8.9		
92	Indeno(1,2,,3-cd)Pyrene					0.049
93	Isophorone			600		
94	Naphthalene					
95	Nitrobenzene			1,900		
96	N-Nitrosodimethylamine				8.1	
97	N-Nitrosodi-n-Propylamine					1.4
98	N-Nitrosodiphenylamine				16	
99	Phenanthrene					
100	Pyrene			11,000		
101	1,2,4-Trichlorobenzene					
102	Aldrin			0.00014		
103	alpha-BHC			0.013		
104	beta-BHC			0.046		
105	gamma-BHC			0.063		

Table 3:	**California Toxic Rule Water Quality Criteria for Toxic Substances**					
	Compound	**Fresh Water**		**Consumption of**	**Salt Water**	
		CMC	**CCC**	**Organisms**	**CMC**	**CCC**
		ppb	**ppb**	**ppb**	**ppb**	**ppb**
106	delta-BHC					
107	Chlordane	2.4	0.0043	0.00059	0.09	0.004
108	4,4'-DDT	1.1	0.001	0.00059	0.13	0.001
109	4,4'-DDE			0.00059		
110	4,4'-DDD			0.00059		
111	Dieldrin	0.24	0.056	0.00014	0.71	0.002
112	alpha-Endosulfan	0.22	0.056	240	0.03	0.009
113	beta-Endosulfan	0.22	0.056	240	0.03	0.009
114	Endosulfan Sulfate			240		
115	Endrin	0.09	0.036	0.81	0.04	0.002
116	Endrin Aldehyde			0.81		
117	Heptachlor	0.52	0.0038	0.00021	0.05	0.004
118	Heptachlor Epoxide	0.52	0.0038	0.00011	0.05	0.004
119-125	Polychlorinated Biphenyls					
			0.014	0.00017		
126	Toxaphene	0.73	0.0002	0.00075	0.21	0.0002

(A copy of this table from the CTR, with all applicable footnotes, is included in Appendix 1. A hardness of 400 mg/L was used to calculate the hardness dependent metal criteria in the above table. No criteria were promulgated where blank spaces are shown.)

Section 3.0 Criteria Used in the Assessment of Violations of Water Quality Standards for Toxic Substances in Newport Bay and San Diego Creek

To identify and rank toxic substance water quality problems in Newport Bay and San Diego Creek, and evaluate compliance with the Basin Plan objectives for toxic substances, monitoring data of various types (described in detail in Section 4) were compared to relevant water quality criteria (including the Basin Plan objectives and CTR objectives cited above), sediment criteria, and fish tissue consumption criteria. The assessment included:

1. Comparison of fish, mussel, and clam tissue monitoring data from the State Mussel Watch program and Toxics Substances Monitoring program to the Food and Drug Administration and National Academy of Science Criteria, Median of International Standards for heavy metals, Maximum Tissue Residue Levels, USEPA risk based consumption criteria, and

California Office of Environmental Health Hazard Assessment (OEHHA) fish advisory criteria.

2. Comparison of 1) toxicity, 2) sediment chemistry, and 3) benthic organism abundance and diversity data from the Bay Protection Toxics Cleanup program, to 1) toxicity control tests, 2) National Oceanic and Atmospheric Administration (NOAA) sediment criteria, and 3) benthic abundance and diversity data from Newport Bay reference stations and other estuaries in Southern California.

3. Comparison of water column monitoring data from Irvine Ranch Water District to the CTR criteria.

4. Comparison of water column and sediment chemistry monitoring data from the County of Orange Public Facilities and Resources Department to the CTR criteria and NOAA sediment criteria, respectively.

5. Comparison of toxicity testing data, water column chemistry, and toxicity identification evaluation data from the County of Orange Public Facilities and Resources Department to toxicity results from analyses of other waste discharges and California Department of Fish Game Acute and Chronic Criteria for diazinon and chlorpyrifos.

6. Comparison of toxicity testing and water column pesticide monitoring data from the Department of Pesticide Regulation to toxicity results from analyses of other waste discharges and California Department of Fish Game Acute and Chronic Criteria for diazinon and chlorpyrifos.

7. Comparison of surface and ground water selenium concentrations measured by Cal State Los Angeles, and others, to CTR criteria for selenium.

It is important to distinguish the legal status of the various types of criteria used in this assessment. In some cases, these criteria are formally adopted, and serve as the basis for legally enforceable regulatory actions. These criteria include the Basin Plan water quality objectives adopted by the Regional Board, and the water quality criteria (objectives) promulgated for California by the U.S. EPA, as outlined in Section 2.1, above. Among other things, these objectives serve as the basis for setting effluent limitations for waste discharges. Violation of these objectives can also trigger federal TMDL requirements and the need for corrective actions. FDA action levels are another type of legally enforceable comparative criteria that, if exceeded, necessitate the removal of shellfish and fish from the marketplace.

However, many of the comparative criteria used have not been promulgated by the USEPA or adopted by the Regional Board as legally enforceable standards or objectives. These include the USEPA and State Department of Fish and Game water quality criteria for diazinon and chlorpyrifos, the fish contamination criteria used by the SWRCB, USEPA, and OEHHA, and the NOAA sediment screening criteria. These criteria are based on the latest scientific research and peer reviewed. They are usually developed using available USEPA protocols for developing water quality, sediment, and biological criteria. Use of these comparative criteria provide a scientifically defensible approach to determining compliance with the narrative objectives for toxic substances contained in the Basin Plan when adopted numeric objectives for a pollutant are not available. For example, the OEHHA fish contamination criteria are based on similar USEPA criteria, which are developed using a risk based approach that estimates human health risk based on the concentration of a pollutant in fish tissue, the amount of fish tissue consumed (usually per month), and the body weight of the individual consuming the contaminated fish tissue. OEHHA uses these risk based criteria as guidance in determining whether fish or shellfish consumption advisories are appropriate to protect public health. Some of the comparative criteria used here (e.g., Maximum Tissue Residue Levels and Median International Standards) are statistically derived and are intended as data assessment tools to indicate water bodies with potential human health and aquatic life concerns.

The following sections describe in more detail the relevant comparative criteria used in this assessment.

Section 3.1 Food and Drug Administration Action Levels; National Academy of Science Guidelines

The Food and Drug Administration (FDA) and the National Academy of Sciences (NAS) have developed criteria (“Action Levels” and “Guidelines”, respectively) for a limited number of toxic substances in freshwater and marine organisms. The criteria for shellfish are shown in Table 4. Those for fish are shown in Table 5.

The FDA Action Levels are intended to protect humans from the chronic effects of toxic substances consumed in foodstuffs. They are based on the assumptions that (1) there is a 1 in 100,000 risk of cancer from consuming fish/shellfish tissue contaminated at or above the specified levels; and (2) that no more than 4, 8-ounce meals of the contaminated tissue are consumed each month. (This type of risk-based approach to evaluating the level of risk to human health posed by contaminated fish tissue is discussed in greater detail in the section below that describes the draft USEPA guidance document on the development of risk-based criteria. Risk-based criteria are also used by OEHHA for DDT, PCB’s and chlordane, as discussed below.)

The NAS Guidelines were established to protect both the organisms containing the toxic substances and the species that consume those organisms. Reflecting this difference, the NAS guidelines for fish are based on whole fish, which predators would consume, while the FDA criteria are based on fish filets, the portion typically eaten by humans.

Table 4: NAS Guidelines and FDA Action Levels for Toxic Chemicals in Shellfish (wet weight)

Chemical	NAS[a] Recommended Guideline for Freshwater Shellfish		FDA[b] Action Levels for Freshwater and Marine Shellfish	
	ug/g (ppm)	ng/g (ppb)	ug/g (ppm)	ng/g (ppb)
Mercury	-	-	1.0[c]	1,000
DDT (total)	1.0	1,000	-	-
PCB (total)	0.5	500	2.0[d]	2,000
Aldrin	-	-	0.3	300
Dieldrin			0.3	300
Endrin			0.3	300
Heptachlor			0.3	300
Heptachlor Epoxide			0.3	300

a. National Academy of Science-National Academy of Engineering. 1973. Water Quality Criteria, 1972 (Blue Book). USEPA, Ecological Research Series

b. U.S. Food and Drug Administration. 1984. Shellfish Sanitation Interpretation: Action Levels for Chemicals and Poisonous Substances, June 21, 1984. USFDA, Shellfish Sanitation Branch, Washington D.C.

c. As methyl mercury

d. A tolerance, rather than an action level, has been established for PCBs (21CFR 109, May 29, 1984). An action level is revoked when a regulation establishes a tolerance for the same substance and use.

Table 5: NAS Guidelines and FDA Action Levels for Toxic Chemicals in Fish (wet weight)

Chemical	NAS[a] Recommended Guideline for Freshwater Fish (Whole Fish)		FDA[b] Action Levels for Freshwater and Marine Fish (Edible Portion)	
	ug/g (ppm)	ng/g (ppb)	ug/g (ppm)	ng/g (ppb)
Mercury	0.5	500	1.0[d]	1,000
DDT (total)	1.0	1,000	5.0	5,000
PCB (total)	0.5	500	2.0[e]	2,000
Aldrin	0.1[c]	100	0.3	300
Dieldrin	0.1[c]	100	0.3	300
Endrin	0.1[c]	100	0.3	300
Heptachlor	0.1[c]	100	0.3	300
Heptachlor Epoxide	0.1[c]	100	0.3	300
Chlordane	0.1[c]	100	0.3	300
Lindane	0.1[c]	100		
HCH	0.1[c]	100		
Endosulfan	0.1[c]	100		
Toxaphene	0.1[c]	100	5	5000

a. National Academy of Science-National Academy of Engineering. 1973. Water Quality Criteria, 1972 (Blue Book). USEPA, Ecological Research Series

b. U.S. Food and Drug Administration. 1984. Shellfish Sanitation Interpretation: Action Levels for Chemicals and Poisonous Substances, June 21, 1984. USFDA, Shellfish Sanitation Branch, Washington D.C.

c. Individually or in combination. Chemicals in this group under NAS Guidelines are referred to as Chemical Group A in this report.

d. As methyl mercury

e. A tolerance, rather than an action level, has been established for PCBs (21CFR 109, May 29, 1984). An action level is revoked when a regulation establishes a tolerance for the same substance and use.

Section 3.2 Maximum Tissue Residue Levels (MTRLs)

The SWRCB staff has developed Maximum Tissue Residue Levels (MTRLs), shown in Tables 6 and 7, to evaluate whether toxic substances are bioaccumulating in fish or shellfish tissue to levels at which there may be a threat to public health. The MTRL is the USEPA CTR water quality criterion for each of the chemicals listed, multiplied by a bioconcentration factor (BCF) that was also developed by the USEPA during the development of the water quality criteria. The bioconcentration factor is an estimate of the average amount of bioconcentration found by the USEPA. This is a rough estimate of a chemical's propensity to bioaccumulate that is used to evaluate whether a chemical, that is not detected in normal water column monitoring, may be bioaccumulating in aquatic resources to levels that may pose a threat to beneficial uses of the waters of the State or public health. MTRLs are used as alert levels or guidelines in water quality assessments and are not compliance or enforcement criteria.

Table 6: Maximum Tissue Residue Levels (MTRLs) In Enclosed Bays and Estuaries

Carcinogens			
Substance	**Water Quality Objective[a] (ug/L)**	**BCF[b] (l/kg)**	**MTRL[c] (ug/kg, ppb)**
Aldrin	0.00014	D	0.33
Chlordane	0.000081	14,100	1.2
DDT (total)	0.0006	53,600	32
Dieldrin	0.00014	4,670	0.7
Heptachlor	0.00017	11,200	1.9
Heptachlor Epoxide	0.00007	11,200	0.8
Hexachlorobenzene (HCB)	0.00069	8,690	6.0
Hexachlorocyclohexane-alpha	0.0013	130	1.7
Hexachlorocyclohexane-beta	0.046	130	6.0
Hexachlorocyclohexane-gama	0.062	130	8.1
PAHs (total)	0.031	30	0.93
PCBs (total)	0.00007	31,200	2.2
Pentachlorophenol (PCP)	8.2	11	90
Toxaphene	0.00069	13,100	9.0
Non-carcinogens			
Endosulfan (total)	2.0	270	500
Endrin	0.8	3,970	3,200
Mercury	0.025	E	1,000
Nickel	4,600	47	220,000

a. From Draft Functional Equivalent Document-Development of Water Quality Plans for: Inland Surface Waters of California and Enclosed Bays and Estuaries of California (SWRCB, 1990b, the Draft April 9, 1991 Supplement to the Function Equivalent Document (SWRCB, 1991).

b. Bioconcentration factors taken from the USEPA 1980 Ambient Water Quality Criteria Documents for each substance.

c. MTRLs were calculated by multiplying the Water Quality Criteria by the BCF, except for aldrin and mercury.

d. Aldrin MTRL is derived from a combination of aldrin and dieldrin risk factors and BCFs as recommended in the USEPA 1980 Ambient Water Quality Criteria for Aldrin/Dieldrin, (USEPA, 1980)

e. The MTRL for mercury is the FDA action level. The water quality objective for mercury in the Enclosed Bays and Estuaries Plan is based on the FDA action level as recommended in the USEPA 1985 Water Quality Criteria for Mercury, (USEPA), 1985)

Table 7: Maximum Tissue Residue Levels (MTRLs) In Inland Surface Waters

Carcinogens			
Substance	**Water Quality Objective[a] (ug/L)**	**BCF[b] (l/kg)**	**MTRL[c] (ug/kg, ppb)**
Aldrin	0.00013	D	0.05
Arsenic	5.0[e]	44	200
Chlordane	0.00008	14100	1.1
DDT (total)	0.00059	53600	32
Dieldrin	0.00014	4670	0.65
Heptachlor	0.00016	11200	1.8
Heptachlor Epoxide	0.00007	11200	0.8
Hexachlorobenzene (HCB)	0.00066	8690	6.0
Hexachlorocyclohexane-alpha	0.0039	130	0.5
Hexachlorocyclohexane-beta	0.014	130	1.8
Hexachlorocyclohexane-gama	0.019	130	2.5
PAHs (total)	0.0028	30	0.08
PCBs (total)	0.00007	31200	2.2
Pentachlorophenol (PCP)	0.28	11	3.1
Toxaphene	0.00067	13100	8.8
Non-carcinogens			
	mg/L	**l/kg**	**mg/kg, ppm**
Cadmium	0.01	64	0.64
Endosulfan (total)	0.0009	270	0.25
Endrin	0.0008	3970	3.0
Mercury	0.000012	F	1.0
Nickel	0.6	47	28

a. From Draft Functional Equivalent Document-Development of Water Quality Plans for: Inland Surface Waters of California and Enclosed Bays and Estuaries of California (SWRCB, 1990b, the Draft April 9, 1991 Supplement to the Function Equivalent Document (SWRCB, 1991).

b. Bioconcentration factors taken from the USEPA 1980 Ambient Water documents for each substance.

c. MTRLs were calculated by multiplying the Water Quality Criteria by the BCF, except for aldrin and mercury.

d. Aldrin MTRL is derived from a combination of aldrin and dieldrin risk factors and BCFs as recommended in the USEPA 1980 Ambient Water Quality Criteria for Aldrin/Dieldrin, (USEPA, 1980)

e. Arsenic MTRL was calculated from the formula NSRL/(WI/BCF) + FC = MTRL. [NSRL (California's No significant Risk Level for arsenic) = 10 ug/d, WI (Water Intake) = 2 liters/day, FC (daily fish consumption) = 0.0065 kg/d].

f. The MTRL for mercury is the FDA action level. The water quality objective for mercury in the Enclosed Bays and Estuaries Plan is based on the FDA action level as recommended in the USEPA 1985 Water Quality Criteria for Mercury, (USEPA), 1985)

Section 3.3 Median International Standards (MIS)

The Food and Agriculture Organization of the United Nations published a survey of human health protection criteria used by member nations (Nauen, 1983). (Table 8) The MIS is the median of the various criteria. These criteria vary somewhat in the tissues to be analyzed and the level of health risk accepted. The MIS do not apply within the United States, but provide a screening tool for assessing bioaccumulation monitoring data.

Table 8: Median International Standards For Trace Elements (ppm, wet weight)[a]

Element	Freshwater Fish	Marine Shellfish	Range	Number of Countries w/ Standards
Arsenic	1.5	1.4	0.1-5.0	11
Cadmium	0.3	1.0	0.05-2.0	10
Chromium	1.0	1.0	1.0	1
Copper	20	20	10-100	8
Lead	2	2	0.5-10	19
Mercury	0.5	0.5	0.1-1.0	28
Selenium	2.0	0.3	0.3-2.0	3
Zinc	45	70	40-100	6

a. Based on: Nauen, C. C., Compilation of Legal Limits for Hazardous Substances in Fish and Fishery Products, Food and Agriculture Organization of the United Nations, 1983.

Section 3.4 Office of Environmental Health Hazard Assessment Criteria

The California Office of Environmental Health Hazard Assessment (OEHHA) is responsible for issuing fish consumption advisories in the State. OEHHA implements a statewide monitoring program of marine waters to evaluate the risk to public health from sportfishing off the coast.

Table 9 below lists the criteria OEHHA uses to screen fish tissue monitoring data to determine if they should collect more tissue data and/or issue fish consumption advisories regarding the number of recommended meals per month. When these screening values are exceeded OEHHA implements a monitoring program that is a statistically rigorous program that collects 20 fish from each station and composites filets from five fish into four different samples, which are then analyzed for toxic substances. If the average concentration of the chemicals from the samples exceeds the criteria, OEHHA issues a consumption advisory. OEHHA also chooses which fish to sample based on sport fishing data so that those species that are consumed by the majority of the people are tested as part of their testing program. Table 9 also lists comparable criteria used by the USEPA. The only difference between the USEPA and OEHHA criteria are the meal size used in the calculation of the criteria.

There are no OEHHA monitoring data now available for Newport Bay. However, OEHHA and the Department of Fish and Game have collected 5 Diamond Turbot, 15 Shiner Surfperch, 5 Black Surfperch, and 15 Speckled Sandabs, from Newport Bay over the past two years. Filets from these fish are currently being analyzed by the Department of Fish and Game Marine Lab at Moss Landing. These data are expected to be available in October 2000. These data will help in the evaluation of all the bioaccumulation data to determine compliance with the Basin Plan narrative objective. The data will also assist the Southern California Coastal Water Research Project (SCCWRP), which has started an investigation of fish tissue concentrations in recreational sport fish caught from Newport Bay. (SCCWRP, Steve Bay, July, 2000) This investigation includes surveys of fish being caught from the Bay, amounts of fish consumed, and tissue concentrations from representative species of fish caught from the Bay. The intent of this study is to provide a more thorough characterization of fish tissue contamination in fish from Newport Bay, using a statistically rigorous sampling plan, The initial results of this two year study will be available by the time the Regional Board is asked to adopt a TMDL for toxic substances in Newport Bay.

Table 9: OEHHA and USEPA Fish Tissue Contamination Screening Values (SV) (OEHHA, June, 1999 Clean Lakes Study (CLS))

Chemical	USEPA[1]	OEHHA[2]
	ppb	ppb
Chlordane	80	30
Chlorpyrifos	30,000	10,000
Total DDT	300	100
Diazinon	900	300
Disulfoton	500	100
Dieldrin	7	2
Total endosulfan	60,000	20,000
Endrin	3000	1000
Ethion	5000	2000
Heptachlorepoxide	10	4
Hexachlorobenzene	70	20
HCH-Lindane	80	30
Toxaphene	10	30
PCBs	10	20
Dioxin TEQ	0.7 ppt	0.3 ppt
Arsenic	3000	1000
Cadmium	10,000	3000
Mercury	600	300
Selenium	50,000	20,000

1. USEPA SVs (USEPA, 1995) for carcinogens were calculated for a 70 kg adult using a cancer risk of 1 x 10-5. SVs for non-cancer effects were calculated for a 70 kg adult and exposure at the RfD (hazard quotient of 1). A fish consumption value of 6.5 g/day was used in both cases.

2. California SVs (CLS-SVs) specifically for the study were calculated according to USEPA guidance (USEPA, 1995). CLS-SVs for carcinogens were calculated for a 70 kg adult using a cancer risk of 1 x 10-5. CLS-LVs for non-cancer effects were calculated for a 70 kg adult and exposure at the RfD (hazard quotient of 1). A fish consumption value of 21 g/day was used in both cases.

The criteria used by OEHHA are risk based like the FDA criteria discussed above, and are based on a specific cancer risk (1 x 10-5) and consumption level per month of contaminated fish tissue (21 grams/day).

Section 3.5 USEPA Draft Risk Based Consumption Criteria

The USEPA has developed a draft guidance document entitled ("Draft Development of Risk Based Consumption Criteria", USEPA, ?? 2000) that outlines a risk based approach to the development of fish and shellfish tissue concentration criteria. This approach acknowledges that health risk varies with the amount of contaminated fish tissue that is consumed, the body weight of the consumer (average adult versus child), and the concentration of the contaminant. As shown in Table 10, these variables are considered together to derive recommended monthly consumption limits. Table 10 shows that as the concentration of DDT in tissue increases, the number of meals recommended declines. This risk based approach, based on consumption amount and tissue concentration, is also the method used by the NAS, FDA and OEHHA to develop their criteria (discussed above), and their respective criteria are also noted in Table 10. (It should be noted that the OEHHA and FDA criteria concentrations, which vary widely, are calculated based on different assumed consumption amounts.) Appendix 2 provides copies of the consumption advisory tables for other toxic substances that have been developed by USEPA.

The USEPA's draft guidance document provides a tool to develop monthly consumption criteria for fish and shellfish tissue that is the same as that used by OEHHA, the FDA, and the NAS in their development of their criteria. For example, Table 10 shows that DDT tissue concentrations at OEHHA's criteria of 100 ppb (0.1 ppm) would result in an advisory to not consume more than 30 meals of contaminated fish and shellfish tissue per month, for 4, 8, and 12 ounce meal sizes, and no more than 23 meals per month for 16 ounce meal sizes. Tissue concentrations at the FDA criteria of 5 ppm, would result in an advisory of no more than 1-4 ounce meal per month, no more than 6-8 to 12 ounce meals per year, and no 16 ounce meals.

Table 10: Monthly Consumption Limits for Chronic Systemic Health Endpoints for the General Population-DDT

Chemical Concentration	Recommended Risk Based Consumption Limit (meals per month)[b]			
in Fish Tissue [a]	4 oz. Meal Size	8 oz. Meal Size	12 oz Meal Size	16 oz Meal Size
Mg/kg or ppm	(0.114 kg)	(0.227 kg)	(0.341 kg)	(0.454 kg)
<0.08	>30	>30	>30	>30
0.08	>30	>30	>30	29
0.09	>30	>30	>30	26
0.1 (OEHHA)	>30	>30	>30	23
0.2	>30	23	15	11
0.3	>30	15	10	7
0.4	23	11	7	5
0.5	18	9	6	4
0.6	15	7	5	3
0.7	13	6	4	3
0.8	11	5	3	2
0.9	10	5	3	2
1 (NAS)	9	4	3	2
2	4	2	1	1
3	3	1	1	6/yr
4	2	1	6/yr	6/yr
5 (FDA)	1	6/yr	6/yr	NONE
6	1	6/yr	6/yr	NONE
7	1	6/yr	NONE	NONE
8	1	6/yr	NONE	NONE
9	1	6/yr	NONE	NONE
10	6/yr	NONE	NONE	NONE
12	6/yr	NONE	NONE	NONE
14	6/yr	NONE	NONE	NONE
16	6/yr	NONE	NONE	NONE
18	6/yr	NONE	NONE	NONE
>18	NONE	NONE	NONE	NONE

None = No consumption recommended.
6/yr = Consumption of no more than 6 meals per year is recommended.
>30 + Although consumption of more than 30 meals/month is allowed, EPA advises limiting consumption to 30 meals in 1 month (1 meal per day)

[a] Instructions for modifying the variables in this Table are found in Section 3.3 of EPA's report. Consumption limits are based on an adult body weight of 70 kg and using a Reference Dose (RfD) = 5 x 10^{-4} mg/kg/d. References of RfDs can be found in Section 5 of the EPA report. The detection limit is 1 x 10^{-4} mg/kg.

[b] Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When this dose is consumed in less than 1 month (e.g., in a few large meals), the daily dose will exceed the RfD.

Section 3.6 National Oceanic and Atmospheric Association (NOAA) Sediment Criteria

Sediment chemistry data collected by the SWRCB/RWQCB's Bay Protection Toxic Cleanup Program (BPTCP) are evaluated using the National Oceanic and Atmospheric Administration (NOAA) Sediment Screening Reference Guidelines (Appendix 3). These guidelines were developed for screening sediment to determine if the sediment can be disposed of in the ocean. These criteria are published in Screening Quick Reference Tables (Appendix 3). These sediment criteria, for inorganic and organic chemicals, are in the form of the Effects Range Low (ERL) and the Effects Range Median (ERM). The ERL is the lowest concentration of the chemical at which toxic effects to aquatic life were found in sediment, and the ERM is the median concentration of a chemical in sediment that causes toxicity to aquatic life that lives in the sediment. The NOAA criteria were developed by evaluating and statistically analyzing toxicity data for a wide range of aquatic species that live in sediment. These data were compiled from sediment toxicity research throughout the country. The SWRCB staff, as part of the BPTCP, identifies areas within the State where sediment concentrations of toxic substances exceed the ERM. Concentrations of toxic substances that exceed the ERM may pose a threat to aquatic life, and therefore indicate threatened violation of the Basin Plan narrative objective.

The sediment toxicity tests results were compared to a control to determine if there was a significant difference between the control response and the sample response. The benthic organism diversity and abundance data was used to calculate the Relative Benthic Index (RBI) to classify areas of Newport Bay as degraded, transitional, or not degraded in terms of benthic community diversity and abundance.

Section 3.7 Toxicity Criteria

Regional Board staff used the chronic toxicity and Toxicity Identification Evaluation (TIE) and Toxicity Reduction Evaluation (TRE) procedures that have been adopted by the Regional Board in numerous NPDES permits for point source discharges to evaluate the water column aquatic toxicity data in the record. These procedures essentially require the completion of a TIE and a Toxicity Reduction Evaluation (TRE) whenever there is an exceedance of the following:

"Two-Month Median of Chronic Toxicity Test results Less than 1.0 TUc and all Single Test Results Less than 1.7 TUc (Test Species: *ceriodaphnia dubia* for fresh water and *americamysis bahia or neomysis mercedis* for marine waters)"

Additionally, staff compared water quality data to USEPA water quality criteria as an indication of aquatic life toxicity. USEPA water quality criteria are developed for toxic substances by evaluating concentrations of toxic substances that cause toxicity to aquatic life using standard USEPA toxicity test methods. Exceedances of USEPA water quality criteria indicate that a chemical may be causing toxicity, but this needs to be confirmed by a Toxicity Identification Evaluation. Staff used USEPA water quality criteria, such as those cited in Table 3 for the California Toxics Rule, as well as criteria for other toxic substances that have not yet been promulgated as water quality objectives, such as the criteria for diazinon and chlorpyrifos. Staff also compared water quality data to the State Department of Fish and Games criteria for diazinon and chlorpyrifos, which is a recalculation of USEPA's criteria for these pollutants using new acute toxicity test data not available to USEPA. The California Department of Fish and Game fresh water CMC and CCC for diazinon, are 0.08 ppb and 0.05 ppb, and their CMC and CCC for chlorpyrifos are 0.02 ppb and 0.014 ppb.

Section 4 Data Used in the Assessment of Violations of Water Quality Standards for Toxic Substances in Newport Bay and San Diego Creek

There is a significant amount of reliable scientifically peer reviewed evidence in the record documenting violations of the narrative water quality objectives for toxic substances in Newport Bay and San Diego Creek. These data sources are discussed in more detail in the following sections and provide the basis for this problem statement.

As summarized in Section 3, and discussed below, there are a number of sources of water quality, sediment quality, toxicity, bioaccumulation, and benthic organism diversity and abundance data that have been used in this assessment. In summary, acute toxicity has been measured in toxicity tests of water and sediment samples collected from San Diego Creek and Newport Bay. TIEs show that discharges of waste pesticides are causing some of this toxicity. Toxic substance concentrations in the water column and sediment are thus adversely affecting beneficial uses. There is also evidence that toxic substances are bioaccumulating to levels that may pose a risk to human health and other biota.

Section 4.1 SWRCB Mussel Watch Data

The State Mussel Watch is a monitoring program conducted by the SWRCB, in coordination with the Regional Boards, that monitors the tissue of resident and transplanted mussels in salt water, and resident and transplanted clams in fresh water, for wet weight concentrations of a wide variety of toxic substances, including metals and pesticides. The SWRCB monitors tissue concentrations for toxic pollutants because many of these chemicals are not detected in routine water column monitoring but bioaccumulate in shellfish. The SMW Program (and the TSM Program discussed next) have been conducted on a Statewide basis every one or two years since 1987. The data are used to assess the spatial distribution of toxic substances in California waters and within specific watersheds, such as Newport Bay/San Diego Creek. The data from locations repeatedly sampled can also be used to assess trends over time. The SMW and TSMP reports are careful to include the caveat that the limited number of samples obtained and analyzed at each sampling station in a single year is generally too small to provide a statistically significant basis for making absolute statements about toxic substances concentrations. Therefore, the reports state that the data reported for a single year should be accepted as indicators of relative levels of toxic pollution in water, not as absolute values. Trends over time and ranking values of a toxic substance in a particular species provide only an indication of areas where fish or shellfish appear to be accumulating concentrations above "normal." Clearly, the statistical significance of the data increases as more samples are collected. SMW and TSMP data for Newport Bay and San Diego Creek have been collected at repetitive locations since 1987, giving more weight to the data as indicators of toxic substance problems. Nevertheless, it is appropriate to keep the foregoing caveat in mind as this data is reviewed and assessed.

To assess the significance of the data, they are compared to the U.S. Food and Drug Administration (FDA) Action Levels for Toxic Chemicals in Shellfish and the National Academy of Science Guidelines in Table 4. The data are also compared to Maximum Tissue Residual Levels (MTRL) in Enclosed Bay and Estuaries and Inland Surface Waters in Tables 6 and 7, and the Median International Standards (MIS) in Table 8. Note that in each case, comparative criteria are available for only a few toxic substances.

The SWRCB Mussel Watch (SMW) Program also ranks the monitoring data based on an Elevated Data Level (EDL) 85 and EDL 95, which are 2 and 1 standard deviations, respectively, above the median value of all the data collected throughout the State. Pollutants identified in the SMW report as being above the EDL 85 and EDL 95 are pollutants measured near the highest concentrations found in shellfish tissue throughout the State. The EDLs are not directly related to potentially adverse human or organism health effects but are used in a relative sense to compare findings.

The SWRCB SMW Summary Report for 1987-93 provides mussel and clam tissue monitoring data from 9 monitoring stations in Newport Bay and 6 stations in the San Diego Creek watershed. (Figure 3) These data are included in Appendix 5. Tables 11 and 142 below provide a summary of these data and serve to identify those toxic substances shown to be bioaccumulating in mussel tissue to levels that exceed the criteria cited in Tables 4, 6, 7 and 8 above.

The SMW monitoring has not found any of the 7 pollutants above the FDA criteria cited in Table 4. However, these data do show bioaccumulation of a number of pollutants in mussel and fresh water clams from Newport Bay and San Diego Creek at levels that may pose a risk to predators. The data also show levels of several pollutants above the MTRLs cited in Tables 6 and 7 and the MIS cited in Table 8. These data also show concentrations of these toxic substances that exceed USEPA risk based consumption criteria cited in Table 10 and in Appendix 2. This shows that there may be some level of risk from eating shellfish from the Bay, depending on the amount of tissue consumed per month and the concentration of these toxic substances in the shellfish.

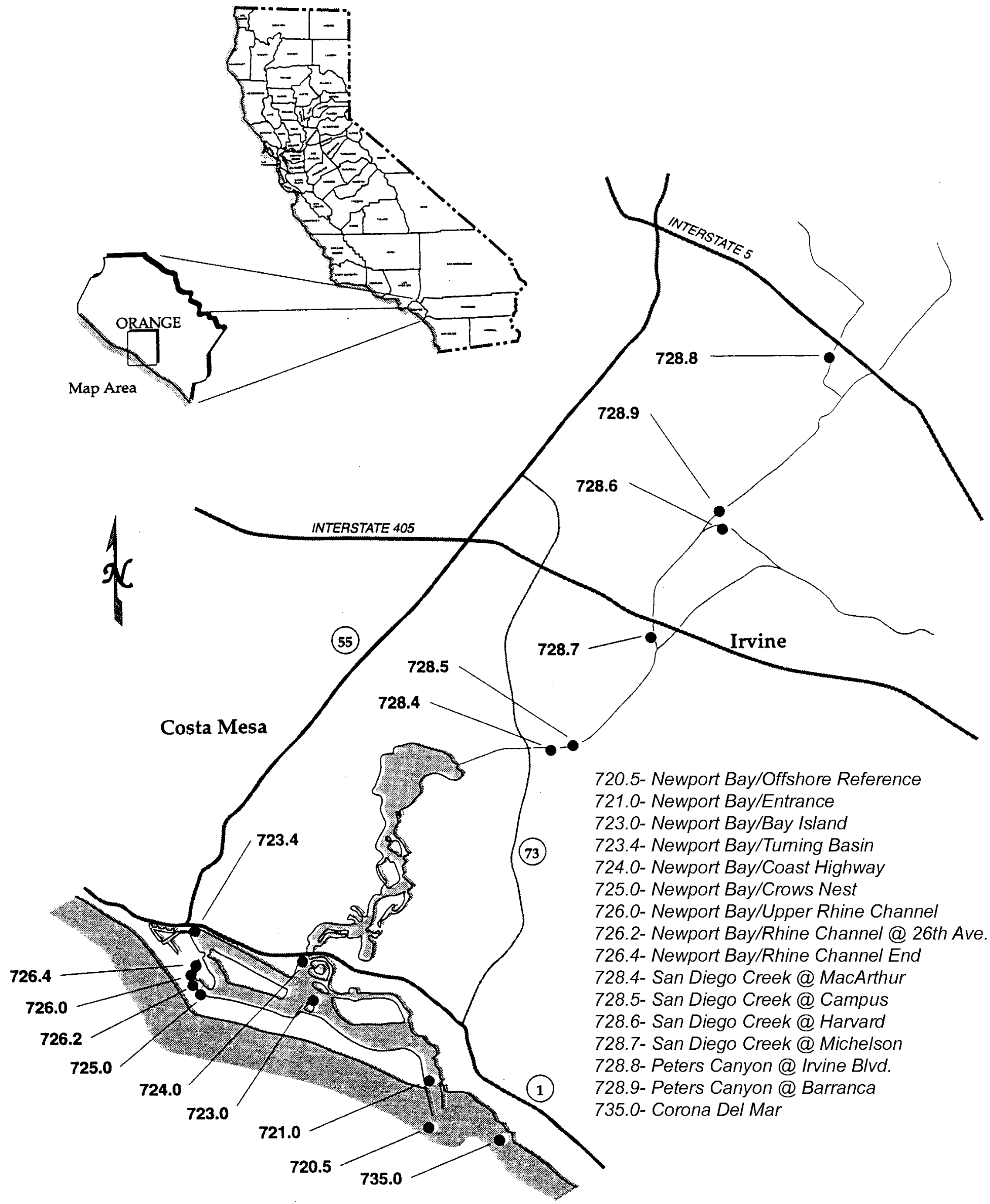

Figure 3: State Mussel Watch Monitoring Stations

Table 11 shows the average of the data for each station, the maximum and minimum values measured, and the number of samples collected during the specified time period. The concentration of each metal across from each station name are the results of the most recent sample collected at the station. As shown in Table 11, the SMW monitoring found that average arsenic levels exceeded the MIS of 1.4 ppm in mussels collected from the Highway 1 Bridge and the Rhine Channel area. The MIS of 1.0 ppm for cadmium was exceeded in the Rhine Channel and other areas of the Bay, as well as San Diego Creek. The MIS for chromium (1.0 ppm) was exceeded in the Rhine Channel and San Diego Creek. Except for the Rhine Channel, copper concentrations in mussel tissue from samples collected throughout the Bay were well below the MIS of 20 ppm, with average concentrations in the range of 2 to 4 ppm. The MIS for mercury, lead, selenium and zinc were also exceeded in the Rhine Channel. As indicated in Section 3, the MIS do not apply in the United States but provide an indication of what other countries consider to be elevated concentrations of trace elements in shellfish. With the exception of an FDA criterion for mercury, there are no NAS/FDA criteria for trace elements in shellfish (see Table 4). The mercury criterion was not exceeded in the Bay or its tributaries, based on the averaged SMW data, except for a value exceeding the FDA criterion recorded in the Rhine Channel.

Table 11: Average Tissue Concentration of Inorganic Toxic Substances In Resident and Transplanted Mussels and Clams that Exceed Select Criteria (SWRCB SMW 1987-96)

Station	Date	Species	Arsenic	Cadmium	Chromium	Copper	Mercury	Lead	Selenium	Zinc
			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Newport Bay/Turning Basin	1/17/96	TCM	1.20	1.50	1.00	3.00	0.04	0.58	0.20	50.00
Average			<7.73	1.32	0.54	2.95	0.04	1.08	-7.85	53.26
Maximum			1.20	1.70	1.90	4.44	0.07	1.60	0.20	71.00
Minimum			<9.00	0.80	0.16	2.17	0.02	0.54	<9.00	38.70
Number of Samples (1986<1996)			8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Newport Bay/Highway 1 Bridge	1/17/96	TCM	1.40	1.30	0.95	2.60	0.12	0.44	0.29	53.00
Average			<7.51	1.23	0.34	2.10	0.04	0.71	<7.67	43.64
Maximum			1.50	1.90	0.95	7.00	0.12	1.17	0.29	75.00
Minimum			<9.00	0.67	0.14	0.82	0.02	0.44	<9.00	28.10
Number of Samples (1982<1996)			14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
Newport Bay/Dunes Dock	12/23/86	TCM	<9.00	1.14	0.39	1.40	0.09	0.87	0.36	46.50
Newport Bay/Crows Nest	1/17/96	TCM	1.20	1.40	2.20	13.00	0.08	0.97	0.20	84.00
Average			<7.62	1.35	0.69	7.07	0.07	1.61	<7.77	63.39
Maximum			1.50	1.70	2.50	21.00	0.11	2.36	0.31	88.00
Minimum			<9.00	0.85	0.17	2.10	0.03	0.49	<9.00	42.00
Number of Samples (1982<1996)			15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00

Table 11: Average Tissue Concentration of Inorganic Toxic Substances In Resident and Transplanted Mussels and Clams that Exceed Select Criteria (SWRCB SMW 1987-96)

Station	Date	Species	Arsenic	Cadmium	Chromium	Copper	Mercury	Lead	Selenium	Zinc
			ppm	ppm	Ppm	ppm	ppm	ppm	ppm	ppm
Newport Bay/Rhine Channel/Upper	12/20/88	TCM	<9.00	1.17	0.27	10.77	0.08	1.90	<9.00	57.90
Average			<7.40	1.19	0.35	8.65	0.07	2.22	<7.67	62.97
Maximum			2.20	1.60	0.55	12.61	0.09	3.13	0.30	73.50
Minimum			<9.00	0.74	0.25	2.96	0.04	1.12	<9.00	53.30
Number of Samples (1982<1988)			7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Newport Bay/Rhine Channel/26th Ave	12/23/86	TCM	<9.00	0.98	0.32	13.13	0.10	1.27	<9.00	67.80
Newport Bay/Rhine Channel/26th Ave	12/20/88	TCM	<9.00	0.76	0.19	1.65	0.03	0.50	<9.00	28.80
Newport Bay/Rhine Channel/End	1/17/96	TCM	1.30	1.60	1.60	15.00	0.08	0.81	0.24	100.00
Average			<7.12	1.40	2.87	30.77	0.49	5.20	<7.32	72.77
Maximum			1.40	2.70	25.00	250.00	4.80	46.00	0.27	130.00
Minimum			<9.00	1.01	0.18	1.26	0.01	0.33	<9.00	25.70
Number of Samples (1986<1996)			11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
San Diego Creek/MacArthur	3/17/93	TFC	<9.00	0.11	0.16	7.00	0.02	0.04	<9.00	11.00
Average			<9.00	1.52	0.30	4.34	0.02	0.12	<9.00	13.91
Maximum			<9.00	8.40	0.95	7.23	0.04	0.22	<9.00	24.50
Minimum			<9.00	0.11	0.02	2.56	0.01	0.04	<9.00	9.40
Number of Samples (1984<1993)			8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
San Diego Creek/Campus	3/14/90	TFC	<9.00	0.21	0.92	7.17	0.03	0.23	<9.00	24.20
San Diego Creek/Harvard	3/7/88	TFC	<9.00	0.89	0.12	3.11	0.01	0.09	<9.00	9.90

Table 11: Average Tissue Concentration of Inorganic Toxic Substances In Resident and Transplanted Mussels and Clams that Exceed Select Criteria (SWRCB SMW 1987-96)

Station	Date	Species	Arsenic	Cadmium	Chromium	Copper	Mercury	Lead	Selenium	Zinc
			ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
San Diego Creek/Michelson	3/17/93	TFC	<9.00	0.15	0.12	9.70	0.05	0.09	<9.00	17.00
Average			<9.00	0.28	1.20	12.97	0.03	0.33	<9.00	25.77
Maximum			<9.00	0.50	2.84	24.01	0.05	0.80	<9.00	45.30
Minimum			<9.00	0.15	0.12	5.20	0.02	0.09	<9.00	15.00
Number of Samples (1990<1993)			3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
San Diego Creek/Irvine Blvd.	3/14/90	TFC	<9.00	0.25	1.17	7.15	0.03	0.76	<9.00	20.60
San Diego Creek/Irvine Blvd.	1/23/91	SED	<9.00	1.40	2.40	1.80	<9.00	12.00	<9.00	9.00
Newport Beach Pier	12/12/80	RBM	<9.00	0.32	0.15	0.88	0.01	0.34	<9.00	15.30
Newport Beach Pier	12/12/80	RCM	<9.00	0.32	0.20	1.59	0.02	1.00	<9.00	22.70
Newport Bay/Entrance/Jetty	12/12/80	RCM	<9.00	0.36	0.16	1.12	0.02	1.26	<9.00	23.70
Average			<9.00	0.33	0.19	1.17	0.02	1.21	<9.00	23.45
Maximum			<9.00	0.45	0.21	1.28	0.03	1.79	<9.00	24.60
Minimum			<9.00	0.20	0.16	0.99	0.02	0.66	<9.00	21.10
Number of Samples (1979<1980)			4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Corona Del Mar	11/29/91	RCM	<9.00	0.30	0.16	1.10	0.02	0.57	<9.00	31.00
Average			<9.00	0.42	0.30	1.37	0.04	1.77	<9.00	33.87
Maximum			<9.00	0.57	0.51	1.80	0.06	2.54	<9.00	46.00
Minimum			<9.00	0.30	0.16	1.05	0.02	0.57	<9.00	28.50
Number of Samples (1977<1991)			7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

Table 12 below summarizes the 1987 - 1996 SMW tissue monitoring results for organic toxic pollutants. These data show that chlordane, DDT, dieldrin, and total PCB's in samples collected from both the Bay and its tributaries exceeded the MTRLs cited in Tables 6 and 7 for these substances. The MTRLs for toxaphene were also exceeded, particularly in the tributaries. MTRLs are an assessment tool used to indicate where toxic substances are bioaccumulating to levels that are a potential public health concern. It is important to note that the concentrations of these toxic substances do not exceed the FDA/NAS criteria cited in Table 4. (There are no FDA or NAS criteria for toxaphene or chlordane.) It is also important to note that the SMW monitoring shows a decline in the tissue concentrations of these pollutants over time. This declining trend is shown in Figures 1 through 10 in Appendix 4. This trend likely reflects the fact that these substances are no longer in use. However, these chemicals may be contributing to toxicity to aquatic life, which is discussed further below in the section pertaining to the Bay Protection Toxics Cleanup Program (BPTCP).

In summary, the SMW data indicate bioaccumulation in shellfish of a number of previously used organic toxic substances to levels that indicate a potential public health concern to consumers. The data suggest at least the threatened violation of the Basin Plan narrative objective that toxic substances not bioaccumulate to levels that are harmful to human health. The data also indicate, however, that the concentrations of these substances are declining over time.

With respect to inorganic toxic substances, the SMW data clearly identified the Rhine Channel as an area warranting further investigation. Further studies were conducted as part of the Bay Protection and Toxic Cleanup Program (the results of this monitoring are described in the next section of this report). Based on these results, the Rhine Channel was designated as a "Toxic Hotspot".

Table 12: Summary of Organic Toxic Substances In Resident and Transplanted Mussels and Clams that Exceed Select Criteria (SWRCB SMW 1977-96)

Station	Date	Species	Chlordane	Chlorpyrifos	Total DDT	Diazinon	Dieldrin	Toxaphene	Total PCB	Tributyltin
			ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb
Newport Pier	12/29/86	RCM	5.00	<8	34.30	<9	<9	<8	24.70	<9
Newport Bay/Offshore Ref	12/21/90	TCM	3.52	<8	30.02	<8	0.62	<8	22.00	<9
Newport Bay/Entrance	12/21/90	TCM	2.67	<8	18.43	<8	0.70	<8	6.03	<9
Average			14.29	<6	102.59	<8.2	<0.59	<2.84	30.88	<9
Maximum			25.47	1.06	170.47	<8	3.60	38.42	45.12	<9
Minimum			2.67	<8	18.43	<9	<9	<8	6.03	<9
Number of Samples (1982-1990)			9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Newport Bay/Police Docks	1/1/86	TCM	27.89	<8	162.49	<8	3.95	<8	60.80	<9
Average			23.60	<8	180.06	<8.25	1.31	<8	69.62	<9
Maximum			31.27	<8	306.33	<8	6.44	<8	94.40	<9
Minimum			4.00	<8	11.35	<9	<9	<8	38.50	<9
Number of Samples (1980-1986)			4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Newport Bay/El Paseo Drive	12/23/86	TCM	21.30	<8	142.70	<8	4.90	<8	64.80	<9
Newport Bay/Bay Island	12/22/91	TCM	14.80	<8	141.10	<9	2.30	<8	66.00	<9
Average			33.02	<7.1	274.36	<8.3	1.07	<3.6	69.02	38.97
Maximum			65.58	1.00	599.74	<8	6.50	35.36	108.00	281.65
Minimum			4.69	<8	22.51	<9	<9	<8	7.31	<9
Number of Samples (1982-1991)			10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

Station	Date	Species	Chlordane	Chlorpyrifos	Total DDT	Diazinon	Dieldrin	Toxaphene	Total PCB	Tributyltin
			ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb
Newport Bay/Turning Basin	1/17/96	TCM	6.01	<8	22.82	<8	0.82	<8	19.01	<9
Average			13.09	-5.77	54.95	<8.125	3.00	-5.04	42.06	44.63
Maximum			28.27	1.14	107.60	<8	9.20	15.65	73.20	420.00
Minimum			6.01	<8	22.82	<9	0.82	<8	8.65	<9
Number of Samples (1986-1996)			8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Newport Bay/Highway 1 Bridge	1/17/96	TCM	9.26	<8	72.60	<8	1.18	<8	18.48	<9
Average			22.68	<3.25	170.76	<7.17	2.59	9.73	41.23	53.64
Maximum			48.39	9.10	385.56	6.60	7.68	87.12	89.27	330.00
Minimum			9.26	<8	44.45	<9	<9	<8	11.50	<9
Number of Samples (1982-1996)			14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
Newport Bay/Dunes Dock	12/23/86	TCM	14.70	<8	144.50	<8	5.60	<8	57.60	<9
Newport Bay/Crows Nest	1/17/96	TCM	10.09	<8	159.13	<8	1.31	<8	148.48	<9
Average			19.07	<5.17	115.40	<8.4	0.92	<0.57	327.15	567.63
Maximum			65.32	1.40	280.26	<8	13.02	50.88	571.29	2830.00
Minimum			<9	<9	<9	<9	<9	<9	44.09	<9
Number of Samples (1982-1996)			15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Newport Bay/Rhine Channel/Upper	12/20/88	TCM	<9	<9	<9	<9	<9	<9	273.60	1188.00
Average			47.04	<5.57	96.92	<8.7	<2.78	<8.4	313.15	957.40
Maximum			221.77	2.98	198.28	<8	13.41	<8	473.80	3190.00
Minimum			<9	<9	<9	<9	<9	<9	96.00	<9
Number of Samples (1982-1988)			7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

Station	Date	Species	Chlordane	Chlorpyrifos	Total DDT	Diazinon	Dieldrin	Toxaphene	Total PCB	Tributyltin
			ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb
LNB/Rhine Channel/26th Ave	12/23/86	TCM	11.00	<8	120.30	<9	<9	<8	216.00	<9
LNB/Rhine Channel/26th Ave	12/20/88	TCM	13.95	1.19	75.49	3.56	3.35	<8	21.60	<9
Newport Bay/Rhine Channel/End	1/17/96	TCM	5.37	<8	30.02	<8	0.92	<8	102.01	<9
Average			10.04	<3.3	63.44	<6.16	0.85	<5.57	200.84	203.16
Maximum			32.81	3.77	208.26	5.85	5.20	22.15	630.00	779.24
Minimum			<9	<9	<9	<9	<9	<9	8.93	<9
Number of Samples (1986-1996)			12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Garden Grove/Wintersburg Channel	1/23/91	TFC	13.31	6.86	28.22	22.54	5.29	<8	29.40	<9
Garden Grove/Wintersburg Channel	3/17/93	TFC	18.90	35.00	95.80	<9	4.40	<8	61.00	<9
Upper Newport Bay/MacArthur	3/17/93	TFC	11.10	42.00	76.00	<9	2.80	110.00	27.00	<9
Average			26.82	24.28	301.91	0.62	4.06	68.11	36.23	<9
Maximum			66.34	45.92	802.78	30.60	10.66	278.80	74.29	<9
Minimum			10.06	0.85	76.00	<9	0.85	<8	17.04	<9
Number of Samples (1984-1993)			7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
San Diego Creek @ Campus	3/14/90	TFC	25.90	25.00	122.70	<8	1.40	100.00	34.00	<9
San Diego Creek @ Harvard	3/7/88	TFC	33.84	<8	327.25	<8	2.87	217.00	10.50	<9
SDC @ Michelson	1/23/91	TFC	12.05	27.36	60.34	<8	1.01	<8	9.36	<9
SDC @ Michelson	3/17/93	TFC	11.50	56.00	93.10	<9	3.80	140.00	21.00	<9

Station	Date	Species	Chlordane	Chlorpyrifos	Total DDT	Diazinon	Dieldrin	Toxaphene	Total PCB	Tributyltin
			ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb
Peters Canyon @ Irvine	3/7/88	TFC	62.98	35.10	242.28	<8	2.88	<8	<8	<9
Peters Canyon @ Barranca	3/14/90	TFC	10.00	2.00	39.70	<8	<8	38.00	13.90	<9
Peters Canyon @ Barranca	1/23/91	SED	13.89	<8	10.63	<8	<8	<8	<8	<9
Corona Del Mar	11/29/91	RCM	0.90	0.80	16.30	<9	0.50	<8	11.00	<9
Average			<1.79	<7.4	21.22	<8.625	<4.02	<8.5	22.37	<9
Maximum			9.07	0.80	41.15	<8	1.38	<8	41.25	<9
Minimum			<9	<9	5.58	<9	<9	<9	8.27	<9
Number of Samples (1977-1991)			8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00

TFC=Transplanted Fresh Water Clam
RCM= Resident California Mussel
TCM=Transplanted California Mussel

Section 4.2 Toxic Substances Monitoring Program Data

The SWRCB's Toxic Substances Monitoring program (TSM) collects samples of fish from inland surface waters of the State, including Newport Bay and San Diego Creek, and analyzes the fish tissue for toxic substances. Marine species are also collected on occasion (including fish from Newport Bay). This program, like the State Mussel Watch Program, collects screening level data to evaluate bioaccumulation of toxic substances in animal tissue to determine if there is sufficient bioaccumulation to pose a threat to beneficial uses of the waters of the State. These data are used to focus subsequent investigations. Since the TSMP collects a limited number of fish tissue samples from Newport Bay and San Diego Creek, it is important to note again that these data are not adequate to make definite conclusions regarding the threat to public health posed by the consumption of fish and shellfish from the Bay and Creek.

As part of the TSM, fish samples have been collected from San Diego Creek and Newport Bay beginning in 1981. (Figure 4) The most recent TSMP monitoring was conducted in 1997, and included three sample locations in Newport Bay and five tributary sample locations in the Newport Bay Watershed. Appendix 4 includes all the TSMP data collected for Newport Bay and its tributaries. This includes monitoring data for fish tissue concentrations for metals and organic toxic substances, including a number of pesticides. The TSMP has collected 10 to 20 samples from Peters Canyon Channel at Barranca and San Diego Creek at Michelson over the past 20 years, which provides a more statistically significant characterization of tissue concentrations at these locations.

The TSMP analyzes the collected fish tissue for 47 different toxic organic substances and 10 heavy metals. Table 13 below summarizes the TSMP data in Appendix 4, showing the analytical results for the 12 organic toxic substances consistently found in one or more locations in the Bay or San Diego Creek at concentrations above the comparative criteria discussed in Section 4. Table 14 summarizes the results of inorganic toxic substances that exceed the MIS listed in Table 8. These tables show the number of samples from each station and the time period of monitoring, the species of fish analyzed, the most recent result for each chemical, and the average, maximum, and minimum of all data for each chemical for each station monitored by the TSMP.

Tables 13 and 14 also indicate whether the whole fish or only a filet of the fish was analyzed. The whole fish is usually analyzed when the fish are small. This does not represent typical human consumption practices, but does reflect what predator species consume. Whole fish concentrations may be 2 to 10 times the concentration found in filets, and the filets of the fish are what are typically consumed by people. There have only been 7 analyses of fish filets from Newport Bay by the TSMP; the remainder have been whole fish analyses. Many of the comparative criteria (FDA, OEHHA, MIS, and USEPA) are based on the edible portion of the fish, rather than whole fish. Thus, the data must be evaluated with caution. To reiterate, the TSMP data are not adequate for determining whether there is a threat to public health resulting from the consumption of fish from the Bay.

As shown in Table 14, the most recent data demonstrate that there are no violations of the FDA action levels (Table 5), even when whole body analytical data are considered. Concentrations of total DDT exceeding the NAS guideline (1000 ppb) have been measured in red shiners collected from San Diego Creek, the Santa Ana Delhi Channel, and Peters Canyon Wash. The most recent data for two of these locations (San Diego Creek and Peters Canyon Wash) indicates that tissue concentrations have declined; however, the measured value for the Peters canyon Wash sample remained close to the NAS guideline. The most recent data on toxaphene concentrations in red shiners collected from these sites indicates that the NAS guideline (100 ppb) was exceeded, although concentrations appear to be declining. Tissue concentrations of toxic substances that exceed NAS guidelines indicate that aquatic organisms and their predators may be adversely affected. This indicates a violation or threatened violations of the Basin Plan narrative objective that toxic substances not cause adverse impacts to beneficial uses.

Two of the ten heavy metals, cadmium and arsenic, were also found in the Rhine Channel area in fish tissue at levels that exceed the MIS (Table 8, Section 3) for these pollutants, in 1990 and 1986 respectively. Copper was also found in red shiner tissue in 1986 to exceed the MIS. The remainder of the metal concentrations from the TSMP are below the MISs for heavy metals listed in Table 8. Data for selenium are shown in Table 14, even though the results of tissue analysis did not indicate bioaccumulation to MIS levels (even in whole body analysis). The data are presented given the evidence presented earlier of exceedances of the CTR criteria for these constituents, and selenium concerns already expressed by stakeholders.

Both the USEPA and the State of California OEHHA have used a screening value for selenium in fish tissue that is an order of magnitude greater than the MIS. Based on the USEPA and OEHHA screening values (which also rely on fish filet analyses rather than whole body) (see Table 9, Section 3) for selenium of 30 ppm and 20 ppm, respectively, the data do not indicate any threat to public health as the result of fish consumption. There are no FDA of NAS criteria for selenium. It is not known whether the concentrations of selenium measured in fish tissue pose a threat to the health of aquatic organisms or predators. This is also shown in Tables 4-11 and 4-12 in Appendix 2, which provide USEPA's risk based calculations for selenium in fish tissue for the general population and children.

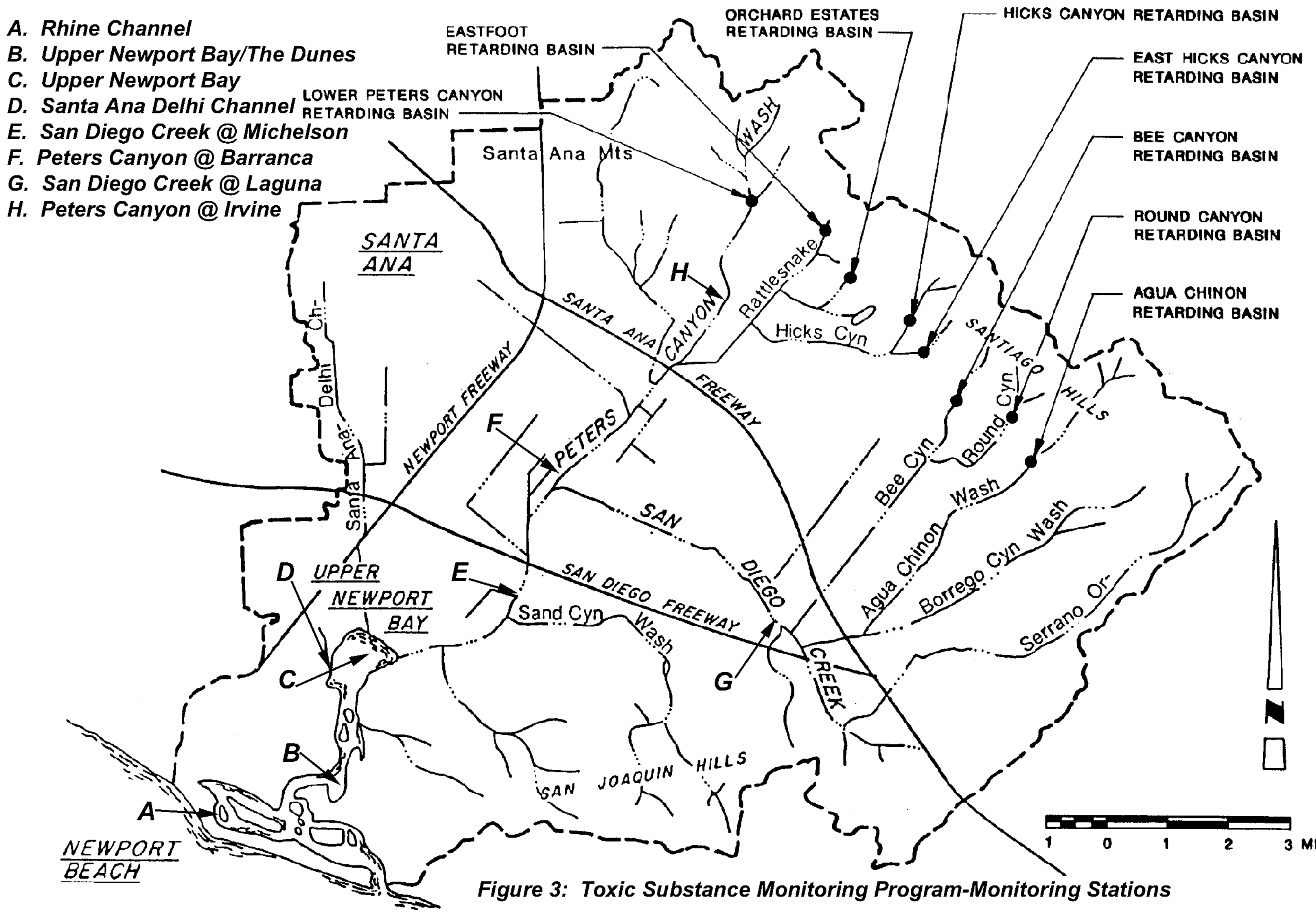

Figure 3: Toxic Substance Monitoring Program-Monitoring Stations

Table 13: Summary of Organic Toxic Substances Monitoring Program Data (SWRCB TSMP 1981-97)

Station	Fish Name	Sample	Total Chlordane	Chlorpyrifos	Dachtal	Total DDT	Diazinon
		Type	ppb	ppb	ppb	ppb	ppb
Upper Newport Bay	Longjaw Mudsucker	Whole					
Average			36.4	<10.0	<5.0	503.2	<5.0
Maximum			49.5	<10.0	<5.0	694.0	<5.0
Minimum			30.9	<10.0	<5.0	353.0	<5.0
Number of Samples (1984-95)			5.0	5.0	5.0	5.0	5.0
Most Recent Sample (1995)			31.5	<10.0	<5.0	364.0	<5.0
Delhi Channel 1985	Goldfish	Filet	17.6	<10.0	<5.0	140.0	<5.00
Delhi Channel 1997	Red Shiner	Whole	8.9	<10.0	<5.0	190.0	<5.00
San Diego Creek/Michelson Drive	Red Shiner	Whole					
Average			101.4	35.9	117.9	1949.1	241.8
Maximum			348.0	82.0	630.0	9553.0	440.0
Minimum			16.8	12.0	5.0	189.0	87.0
Number of Samples (1983-97)			20.0	14.0	21.0	21.0	4.0
Most Recent Sample (1997)			25.2	<10.0	5.0	189.0	<5.00
San Diego Creek/Barranca Parkway	Red Shiner	Whole					
Average			89.4		29.0	1260.3	
Maximum			203.0	0.0	100.0	2896.0	0.0
Minimum			14.6	0.0	6.7	96.0	0.0
Number of Samples (1987-97)			6.0	0.0	6.0	7.0	0.0
Most Recent Sample (1997)							
San Diego Creek/Laguna Road (1987)	Red Shiner	Whole	67.3	<10.0	27.0	667.0	<5.00
Lower NB/Rhine Channel (1997)	Chub Mackerel	Filet		<10.0	<5.0	141.0	<5.00

Table 13: Summary of Organic Toxic Substances Monitoring Program Data (SWRCB TSMP 1981-97)

Station	Fish Name	Sample	Total Chlordane	Chlorpyrifos	Dachtal	Total DDT	Diazinon
Peters Canyon Channel	Red Shiner	Whole	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
Average			63.6	64.8	88.4	1244.1	128.5
Maximum			142.5	120.0	670.0	2720.0	180.0
Minimum			26.3	15.0	5.6	522.0	74.0
Number of Samples (1989-97)			11.0	8.0	9.0	11.0	4.0
Most Recent Sample (1997)			40.9	83.0	<5.0	967.0	
Newport Bay/Newport Dunes	Bass, Perch,	Filet					
Average	Croaker, Turbot		6.6	<10.0	<5.0	130.6	<5.0
Maximum			7.7	0.0	0.0	277.0	0.0
Minimum			5.4	0.0	0.0	48.0	0.0
Number of Samples (1989-97)			2.0	0.0	0.0	5.0	0.0
Most Recent Sample (1997)				<10.0	<5.0	152.0	<5.00

Station	Fish Name	Sample	Dieldrin	Endosulfan	Tot. HCH	Hexachlorobenzene	
		Type	**ppb**	**ppb**	**ppb**	**ppb**	
Upper Newport Bay	Longjaw Mudsucker	Whole					
Average			<5			<2.0	
Maximum			10.0			<2.0	
Minimum			<5			<2.0	
Number of Samples (1984-95)			5.0	0.0	0.0	5.0	
Most Recent Sample (1995)			<5.0			<2.0	
Delhi Channel 1985	Goldfish	Filet	<5.0		3.1	<2.0	
Delhi Channel 1997	Red Shiner	Whole	5.5			<2.0	

Table 13: Summary of Organic Toxic Substances Monitoring Program Data (SWRCB TSMP 1981-97)							
Station	**Fish Name**	**Sample**	**Dieldrin**	**Endosulfan**	**Tot. HCH**	**Hexachlorobenzene**	
San Diego Creek/Michelson Drive	Red Shiner	Whole	**ppb**	**ppb**	**ppb**	**ppb**	
Average			25.1	98.6	7.6	4.2	
Maximum			80.0	335.0	19.0	9.8	
Minimum			6.8	6.6	2.8	2.1	
Number of Samples (1983-97)			18.0	9.0	7.0	11.0	
Most Recent Sample (1997)			11.0			4.2	
San Diego Creek/Barranca Parkway	Red Shiner	Whole					
Average			19.9	6.2		3.6	
Maximum			34.0	6.2	0.0	3.6	
Minimum			6.0	6.2	0.0	3.6	
Number of Samples (1987-97)			5.0	1.0	0.0	1.0	
Most Recent Sample (1997)							
San Diego Creek/Laguna Road (1987)	Red Shiner	Whole	13.0	312.0	14.0	2.2	
Lower NB/Rhine Channel (1997)	Chub Mackerel	Filet	<5.0			<2.0	
Peters Canyon Channel	Red Shiner	Whole					
Average			24.3	130.0	10.2	5.4	
Maximum			140.0	130.0	12.0	10.0	
Minimum			5.4	130.0	8.3	2.3	
Number of Samples (1989-97)			11.0	1.0	2.0	3.0	
Most Recent Sample (1997)			11.0			<2.0	
Newport Bay/Newport Dunes	Bass, Perch,	Filet					
Average	Croaker, Turbot		<5.0	10.0			
Maximum			0.0	10.0	0.0	0.0	
Minimum			0.0	10.0	0.0	0.0	
Number of Samples (1989-97)			0.0	1.0	0.0	0.0	
Most Recent Sample (1997)			<5.0			<2.0	

Table 13: Summary of Organic Toxic Substances Monitoring Program Data (SWRCB TSMP 1981-97)

Station	**Fish Name**	**Sample Type**	**Total PCBs ppb**	**Toxaphene ppb**	**Oxidiazon ppb**		
Upper Newport Bay	Longjaw Mudsucker	Whole					
Average			122.0	<10.0	29.0		
Maximum			140.0	210.0	36.0		
Minimum			96.0	<10.0	22.0		
Number of Samples (1984-95)			3.0	5.0	2.0		
Most Recent Sample (1995)			140.0	<10.0	22.0		
Delhi Channel 1985	Goldfish	Filet	240.0	<10.00			
Delhi Channel 1997	Red Shiner		89.7	495.0	8.7		
San Diego Creek/Michelson Drive	Red Shiner	Whole					
Average			208.0	1058.1	473.0		
Maximum			560.0	7700.0	1800.0		
Minimum			58.0	120.0	70.0		
Number of Samples (1983-97)			18.0	20.0	13.0		
Most Recent Sample (1997)			208.0	121.0	76.0		
San Diego Creek/Barranca Parkway	Red Shiner	Whole					
Average			135.2	313.3	626.0		
Maximum			256.0	570.0	2200.0		
Minimum			62.0	130.0	100.0		
Number of Samples (1987-97)			5.0	6.0	5.0		
Most Recent Sample (1997)							
San Diego Creek/Laguna Road (1987)	Red Shiner	Whole		300.0			
Lower NB/Rhine Channel (1997)	Chub Mackerel	Filet	346.9	<10.00	<5.0		

Table 13: Summary of Organic Toxic Substances Monitoring Program Data (SWRCB TSMP 1981-97)							
Station	**Fish Name**	**Sample**	**Total PCBs**	**Toxaphene**	**Oxidiazon**		
		Type	**ppb**	**ppb**	**ppb**		
Peters Canyon Channel	Red Shiner	Whole					
Average			91.4	487.7	380.9		
Maximum			148.0	1400.0	1800.0		
Minimum			57.5	260.0	42.0		
Number of Samples (1989-97)			5.0	11.0	11.0		
Most Recent Sample (1997)			67.6	447.0	48.0		
Newport Bay/Newport Dunes	Bass, Perch,	Filet					
Average	Croaker, Turbot		115.0				
Maximum			135.0	0.0	0.0		
Minimum			95.0	0.0	0.0		
Number of Samples (1989-97)			2.0	0.0	0.0		
Most Recent Sample (1997)				<10.00	<5.0		

Table 14: Summary of Inorganic Toxic Substances Monitoring Program Data (SWRCB TSMP 1981-97)

STATION	SPECIES	TISSUE	DATE		As		Cd		Se
					ppm		ppm		ppm
NEWPORT BAY	SSB	L	7/16/90		1.50		0.76	<	NA
SAN DIEGO CR/MICHELSON DR	PRS	W	6/17/95		0.15		0.12		1.10
Average					0.10		0.10		1.20
Maximum					0.20		0.29		1.60
Minimum					0.05		0.03		0.29
Number of Samples (1983-1995)					18.00		18.00		18.00
SAN DIEGO CR/BARRANCA PKWY	PRS	W	5/16/91		0.10		0.08		1.60
Average					0.09		0.14		1.16
Maximum					0.13		0.16		1.60
Minimum					0.05		0.08		0.83
Number of Samples (1987-1991)					7.00		7.00		7.00
SAN DIEGO CR/LAGUNA RD	PRS	W	7/23/87		0.09		0.32		1.60
EL MODENA CH/U/S/ WALNUT AVE BRG	PRS	W	5/16/91	<	0.05		0.31		1.10
PETERS CANYON CHANNEL	PRS	W	6/17/95		0.09		0.14		1.30
Average					0.09		0.12		1.27
Maximum					0.10		0.15		1.60
Minimum					0.07		0.03		1.10
Number of Samples (1989-1995)					10.00		10.00		10.00
NEWPORT BAY	BCK	F	6/18/95		1.20	<	0.01		0.34
Average					1.55		0.18		0.40
Maximum					1.90		0.35		0.45
Minimum					1.20		0.01		0.34
Number of Samples (1991-1995)					5.00		5.00		5.00

SSB-Spotted Sand Bass, BCK-Black Croaker, PRS-Pacific Red Shiner
W-Whole Fish, F-Filet, L-Lipid

Section 4.3 Bay Protection Toxics Cleanup Program Data

The Bay Protection Toxic Cleanup Program)BPTCP) is an outgrowth of the TSM and SMW monitoring programs. Based on the results of the SMW and TSM data Regional Board staff identified potential toxic hot spots where the data shows evidence of bioaccumulation that may pose a threat to beneficial uses. These areas were targeted for further investigation. As part of the BPTCP, the State Water Resources Control Board, together with the National Oceanic and

Atmospheric Administration (NOAA), the Regional Board, the California Department of Fish and Game, the University of California at Santa Cruz, and San Jose State University Moss Landing Marine Laboratories, conducted a study, and published a report entitled "Sediment Chemistry, Toxicity, and Benthic Conditions in Selected Water Bodies of the Santa Ana Region, August 1998." This study provides monitoring data from throughout Newport Bay on:

1. Concentrations of toxic substances found in sediment samples collected throughout the Bay.

2. Concentrations of toxic substances found in the pore water of the sediment samples.

3. Concentrations of toxic substances found in fish tissue, from fish collected from the Rhine Channel area.

4. Toxicity to aquatic life in the sediment and the pore water of the sediment.

5. The relative benthic index, based on the abundance and diversity of benthic organisms living in the sediment.

Section 4.3.1 Sediment Chemistry

Figure 5 below, shows the locations of sample stations throughout Newport Bay that were used in the BPTCP study. These sample locations provide a general overview of sediment quality throughout Newport Bay. Sediment samples were collected from each of these stations, and both the sediment and the pore water within the sediment sample were analyzed for toxic substances. The concentrations of toxic substances in the sediment were compared with the NOAA sediment criteria discussed in Section 3. As discussed above these criteria are in the form of an Effects Range Median (ERM), which is the median concentration of a toxic substance in sediment found to be toxic to aquatic life. The ERM is the level at which toxicity to aquatic life in the sediment may be present, depending on the type of aquatic life that lives in sediment. The ERM for all the toxic substances found in the sediment and pour water is then combined in a calculation to develop an ERM Quotient. The ERM Quotient is an overall measure of the concentrations of all toxic substances found in the sediment that is used to rank contaminated areas throughout the Bay.

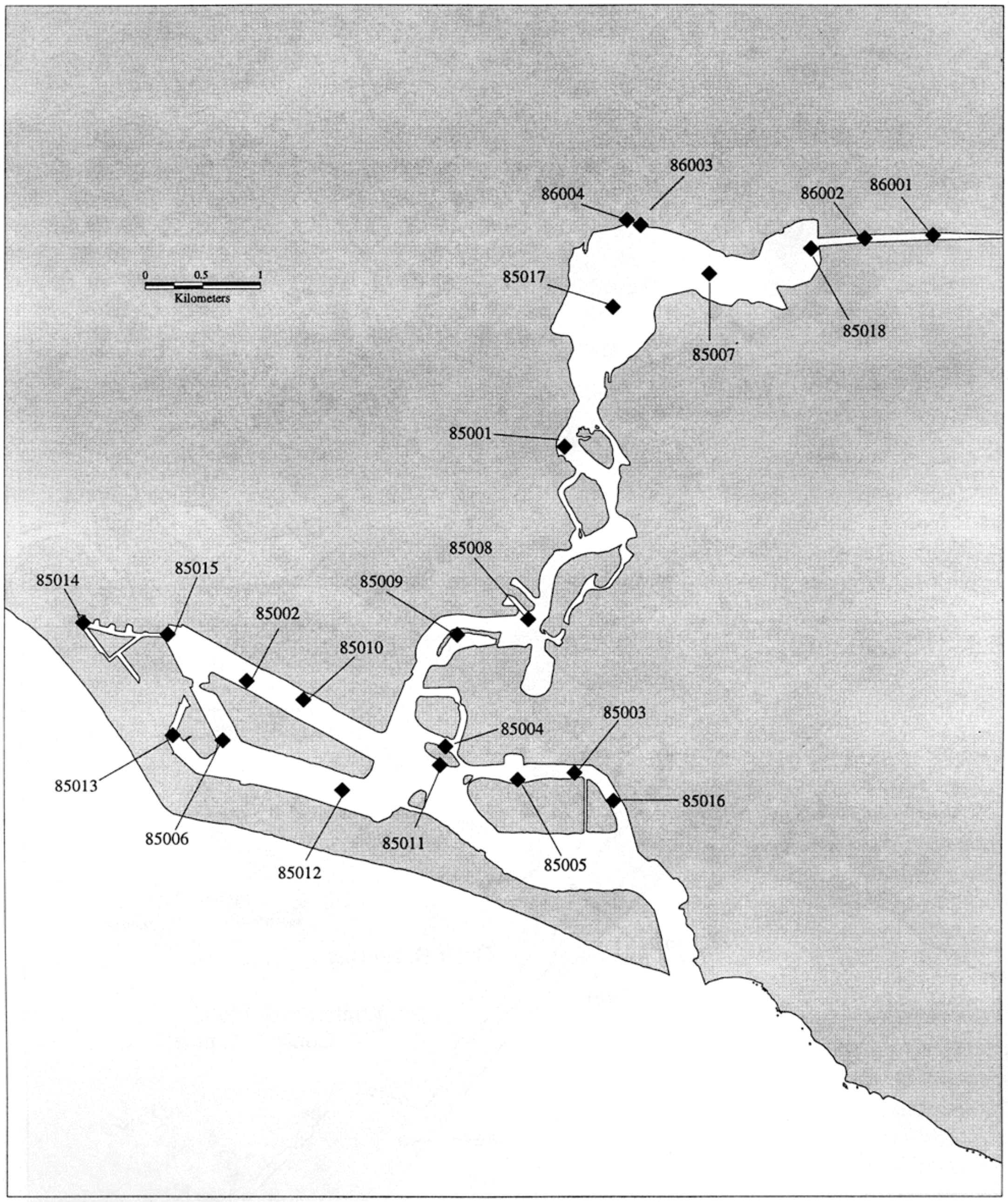

Figure 5: BPTCP Newport Bay Sampling Locations

Figure 6 below, shows the average ERM Quotient for the monitoring stations in Newport Bay used by the BPTCP. As shown in this figure, the Newport Island and the Rhine Channel areas had the highest levels of chemical contamination in the sediment. The Rhine Channel and Newport Island areas of the Bay are known to have poor tidal flushing, which may contribute to the higher contaminant levels. If the ERM Quotient is greater than 0.5, the sediment is considered elevated, and if the ERM Quotient is less than 0.1 the sediment is considered not likely to pose a threat to aquatic life. An ERM Quotient in between these numbers indicates an intermediate level of contamination of the sediment.

In addition to using the ERM Quotient to evaluate general sediment quality, the BPTCP report also evaluated the concentrations of the individual toxic substances in sediment from throughout the Bay. These concentrations were compared to the ERM for each respective substance. Figure 7 shows that copper, mercury, zinc, and total PCB ERM values were exceeded in the Rhine Channel and Newport Island areas (and one location in the main channel of the Lower Bay), contributing to the high ERM quotients in those areas. Figure 8 shows the total chlordane concentrations from the sediment samples collected throughout the Bay. The data was also compared to the Threshold Effects Limit (TEL) and the Effects Range Limit (ERL), which are the lowest measured concentration shown to cause toxic effects to aquatic life. This figure shows that there are areas within the Bay with chlordane concentrations in the sediment that exceed the ERM, or are slightly below the ERM. Only two sites within the Bay show concentrations of chlordane below the ERL. Figure 9 below shows the concentrations of DDE found in sediment samples from throughout the Bay. DDE is a breakdown product of DDT. As shown in Figure 9 there are widespread relatively high concentrations of DDE found in sediment samples throughout the Bay. This is in stark contrast to the distribution of heavy metals and PCBs in sediment, as shown in Figure 7.

To provide some perspective on these data in comparison to other data collected by the BPTCP statewide, one of the conclusions reached by the study report authors is that the chemical contamination in Newport Bay was generally considered to be low in most areas and moderate in a few areas relative to other more highly industrialized areas.

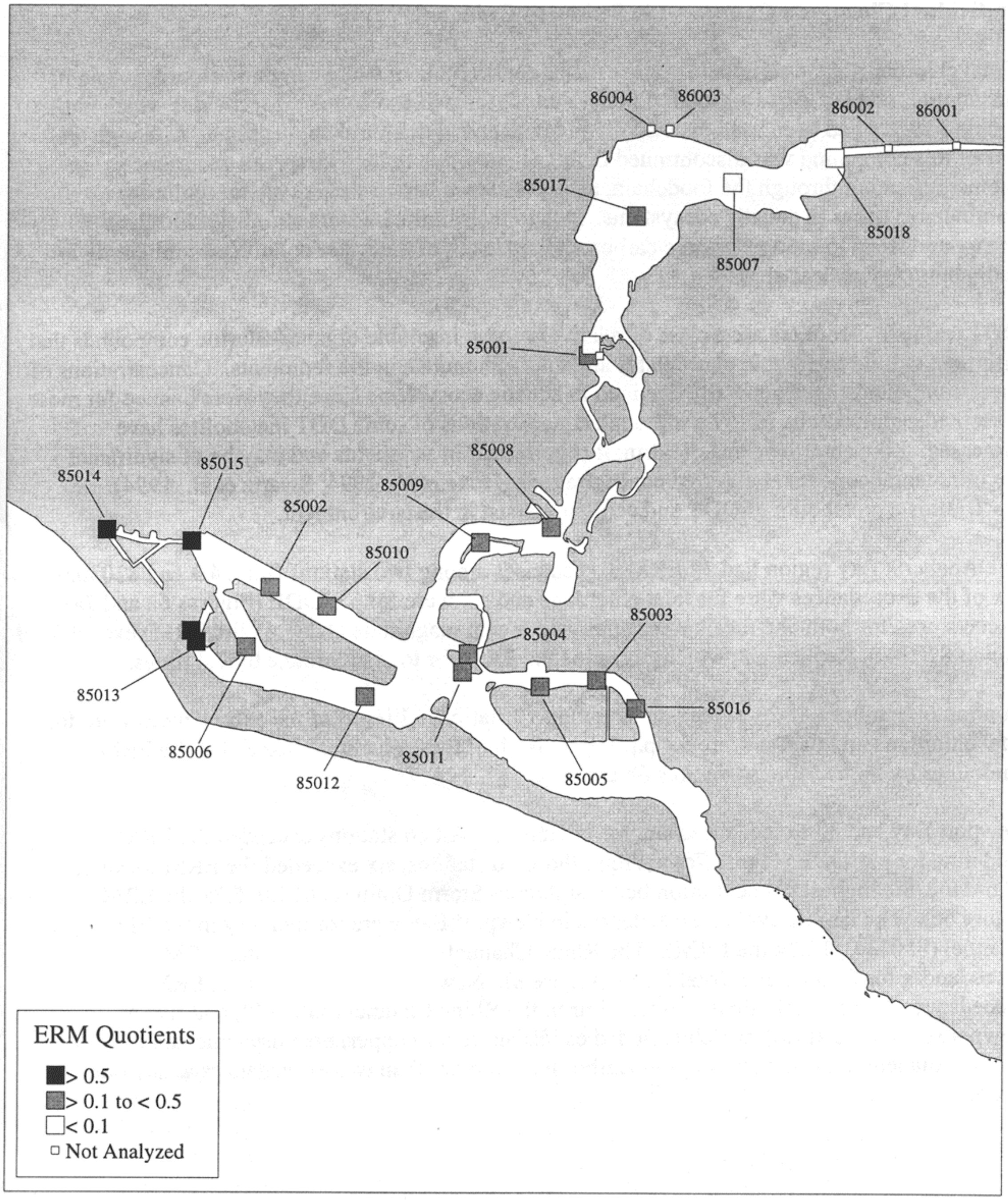

Figure 6: Average ERM Quotient for the monitoring stations in Newport Bay used by the BPTCP.

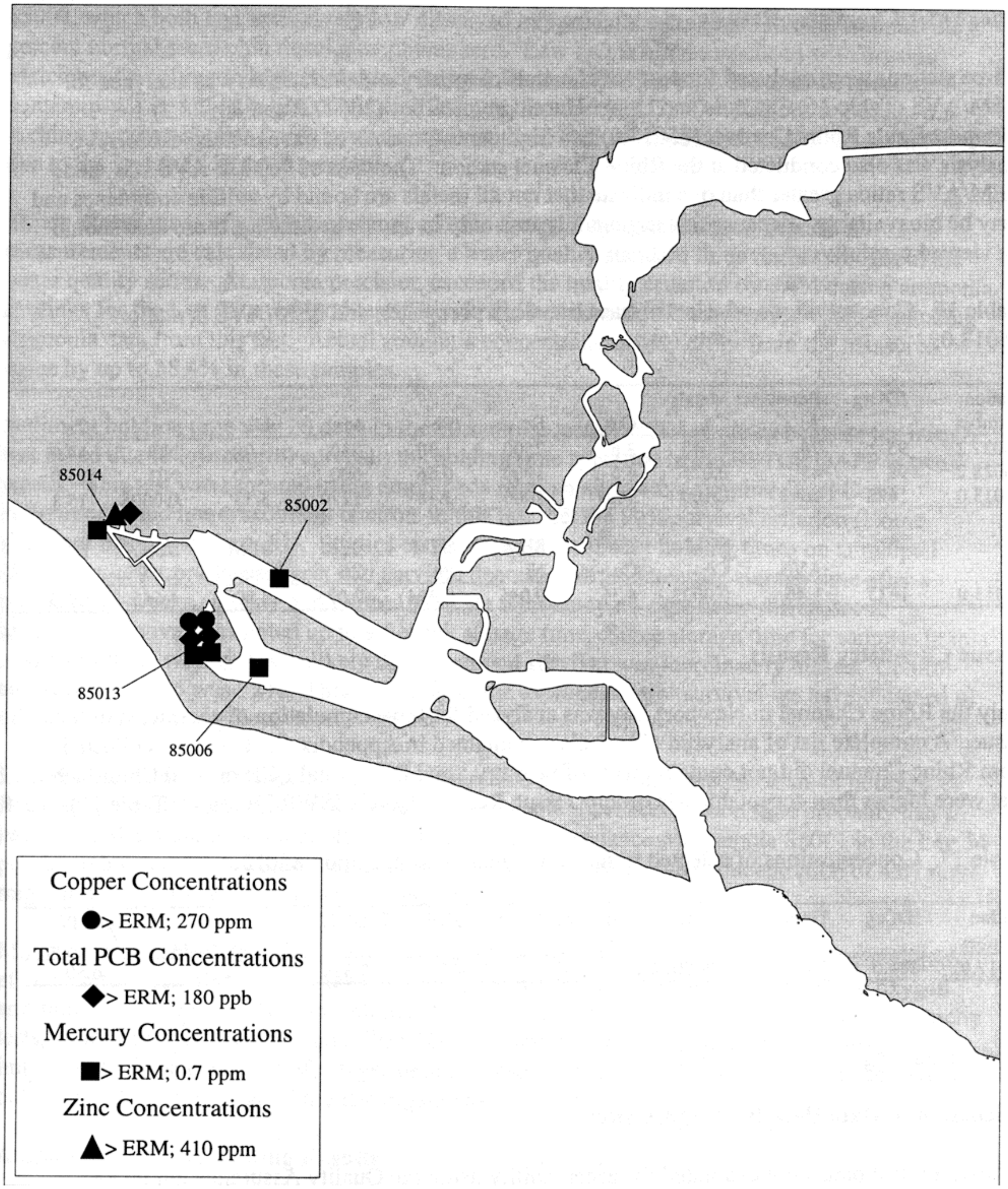

Figure 7: Copper, total PCB, Mercury, and Zinc Concentrations for Stations in Newport Bay

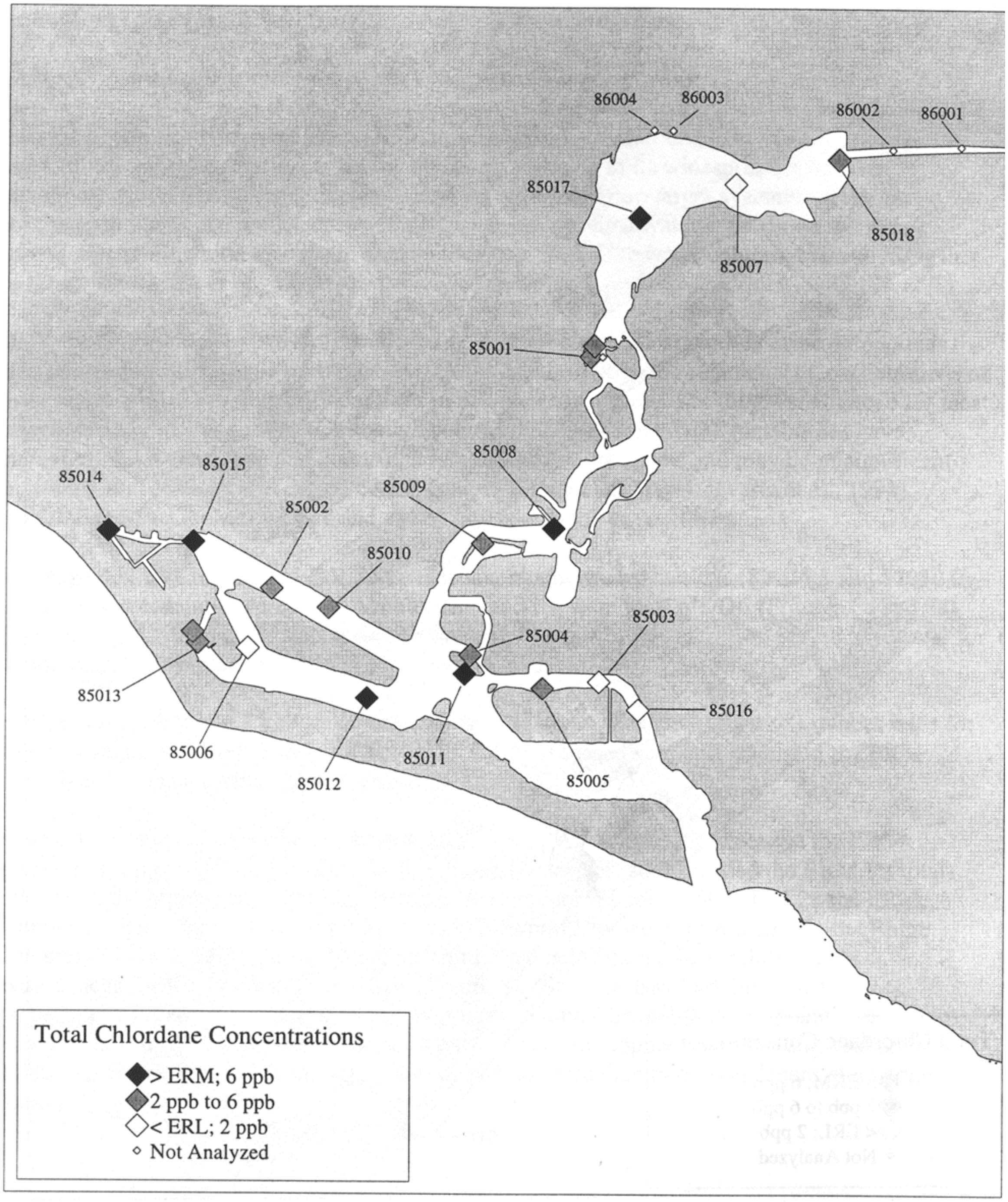

Figure 8: Total Chlordane Concentrations for Stations in Newport Bay

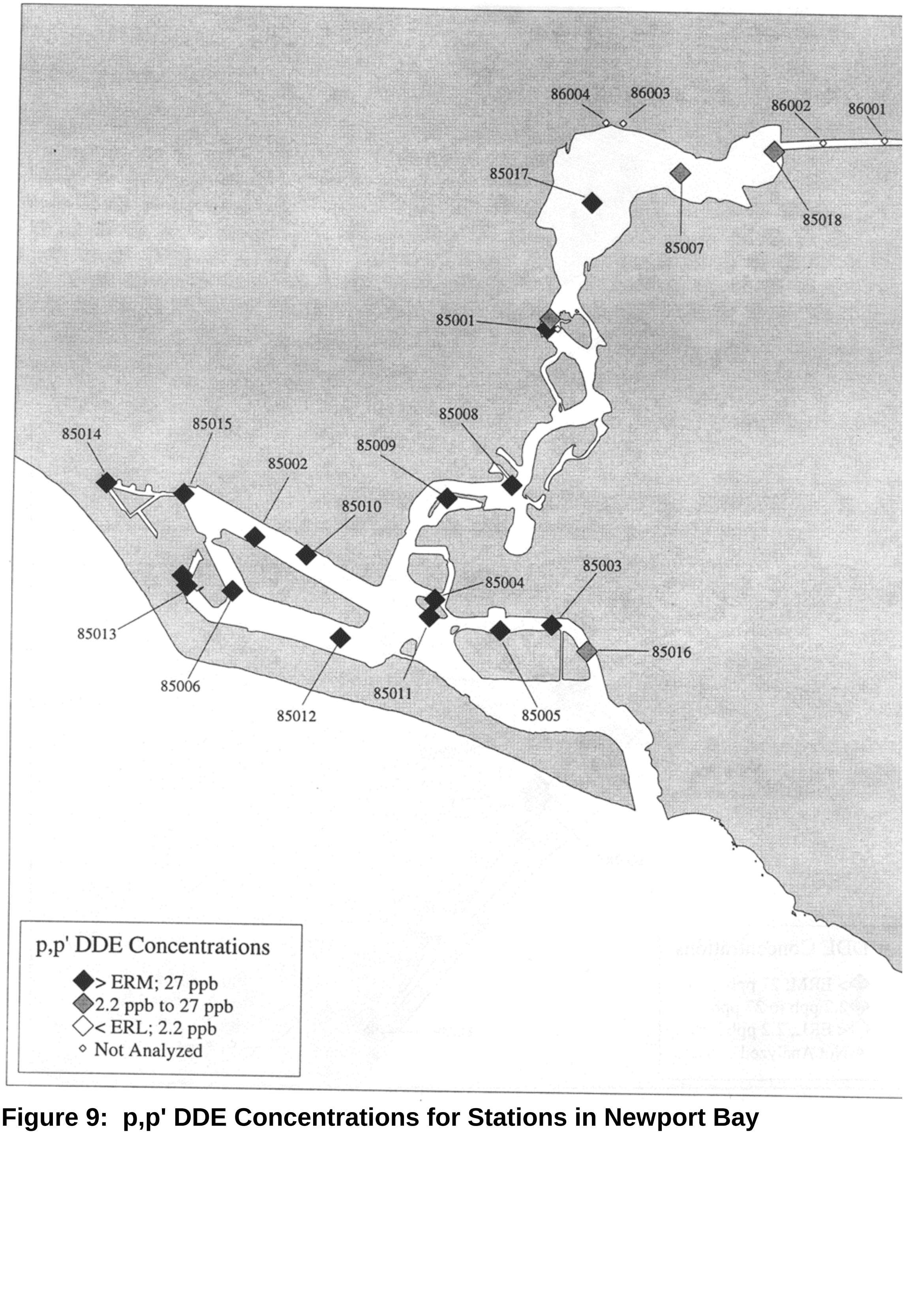

Figure 9: p,p' DDE Concentrations for Stations in Newport Bay

Section 4.3.2 Pore water chemistry

Results of analyses of sediment pore water samples collected throughout the Bay indicate that the Rhine Channel had high concentrations of copper, mercury, DDE, and PCB's, thereby having a potential to result in toxicity. The remaining stations showed evidence of elevated concentrations of chlordane and DDE.

Section 4.3.3 Fish Tissue Chemistry

The BPTCP monitoring program only collected samples of fish (topsmelt) tissue from the Rhine Channel area , for analysis for toxic substances . These data show that mercury , DDT , PCBs , chlordane and toxaphene are all below the MTRLs , the NAS and FDA criteria, and the OEHHA screening values.

Section 4.3.4 Sediment and Pore Water Toxicity

Sediment samples collected throughout the Bay were also subjected to toxicity testing using amphipods and purple sea urchin larvae, to determine if the chemicals that were found to exceed the ERMs were causing toxicity to aquatic life. As shown in Figure 10 below, toxicity to aquatic life in the sediment was mostly observed in the Rhine Channel and Newport Island areas, which were also the areas with the highest ERMQ values. Toxicity was also observed on the north and south sides of Lido Island and at two locations in the Upper Bay.

Section 4.3.5 Relative Benthic Index

Finally, the BPTCP collected samples of benthic organisms at each of the station. Both the total number and types of benthic organisms were quantified, and used to calculate their Relative Benthic Index (RBI). Figure 12 below shows the results of this Benthic index survey. As shown most of the sites throughout the Bay are either degraded or transitional. It is noteworthy that the Rhine Channel and Newport Island areas, with the highest ERM Quotients, were classified as transitional, suggesting that factors other that toxic substance concentrations, for example, dredging, have an effect on the benthic community. The BPTCP did evaluate the effects of ammonia and dissolved sulfides in the sediment, and these chemicals did not correlate with the sediment and pore water toxicity.

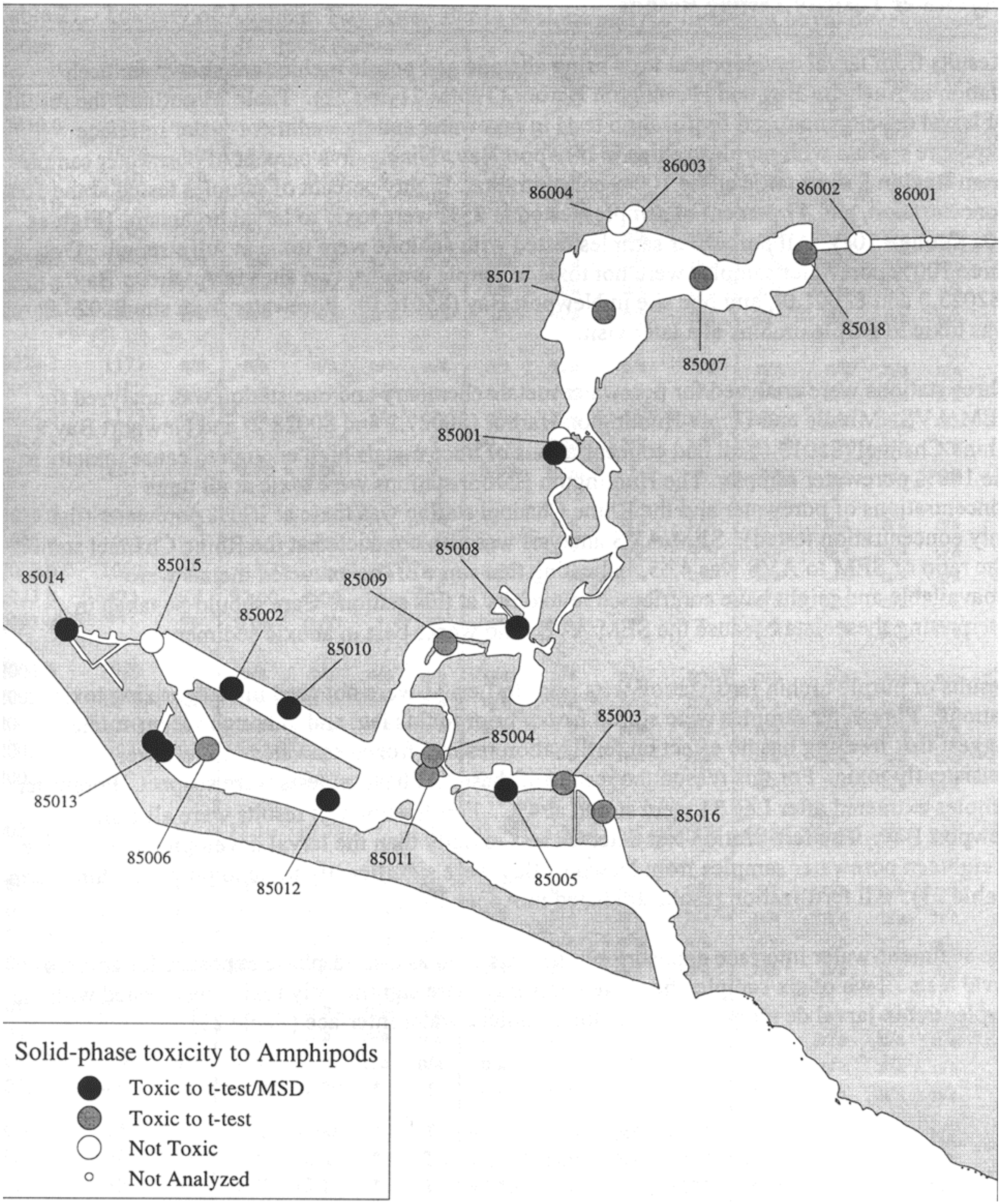

Figure 10: Solid Phase Toxicity to Amphipods in Newport Bay

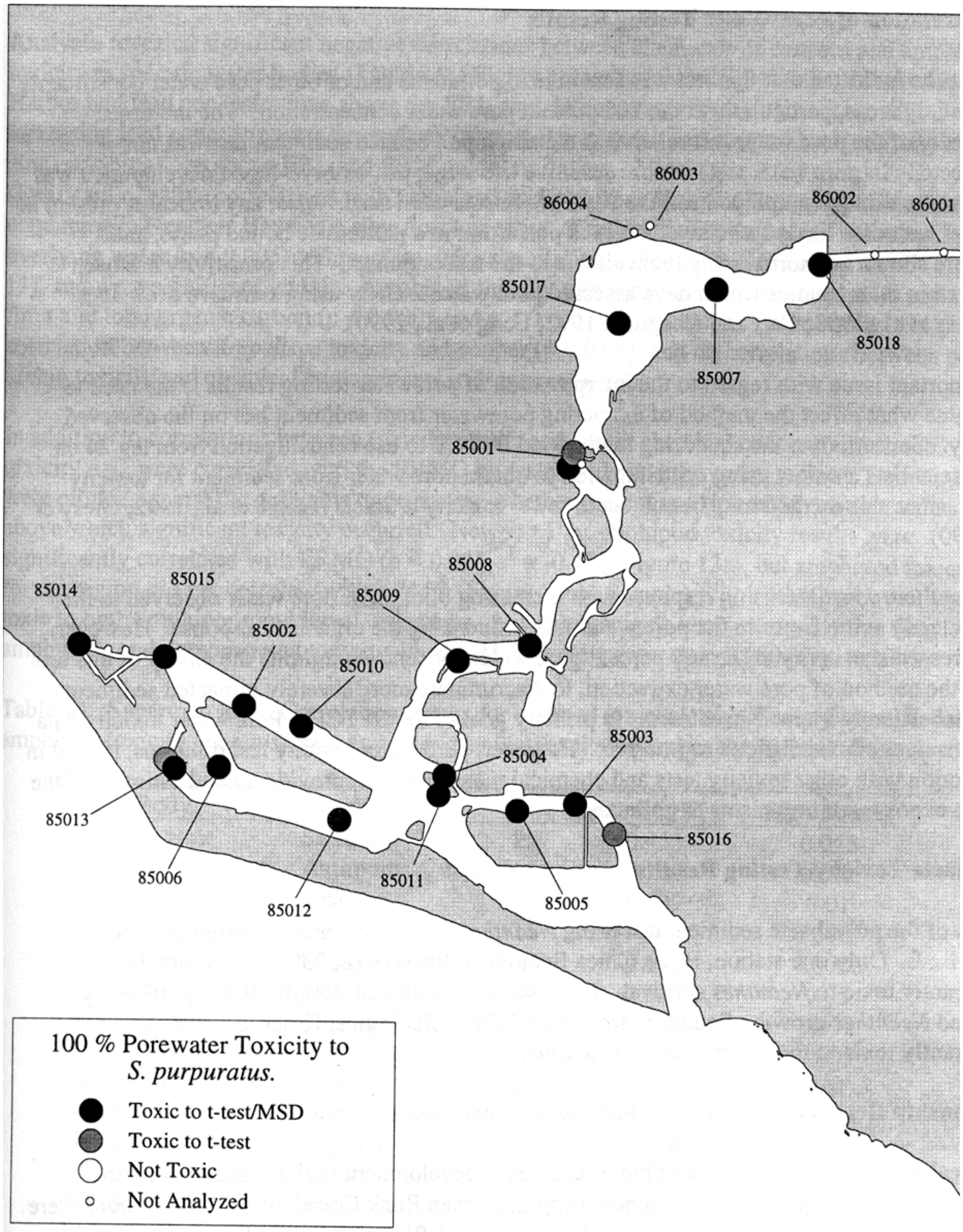

Figure 11: Porewater Toxicity to Larval Development in Newport Bay

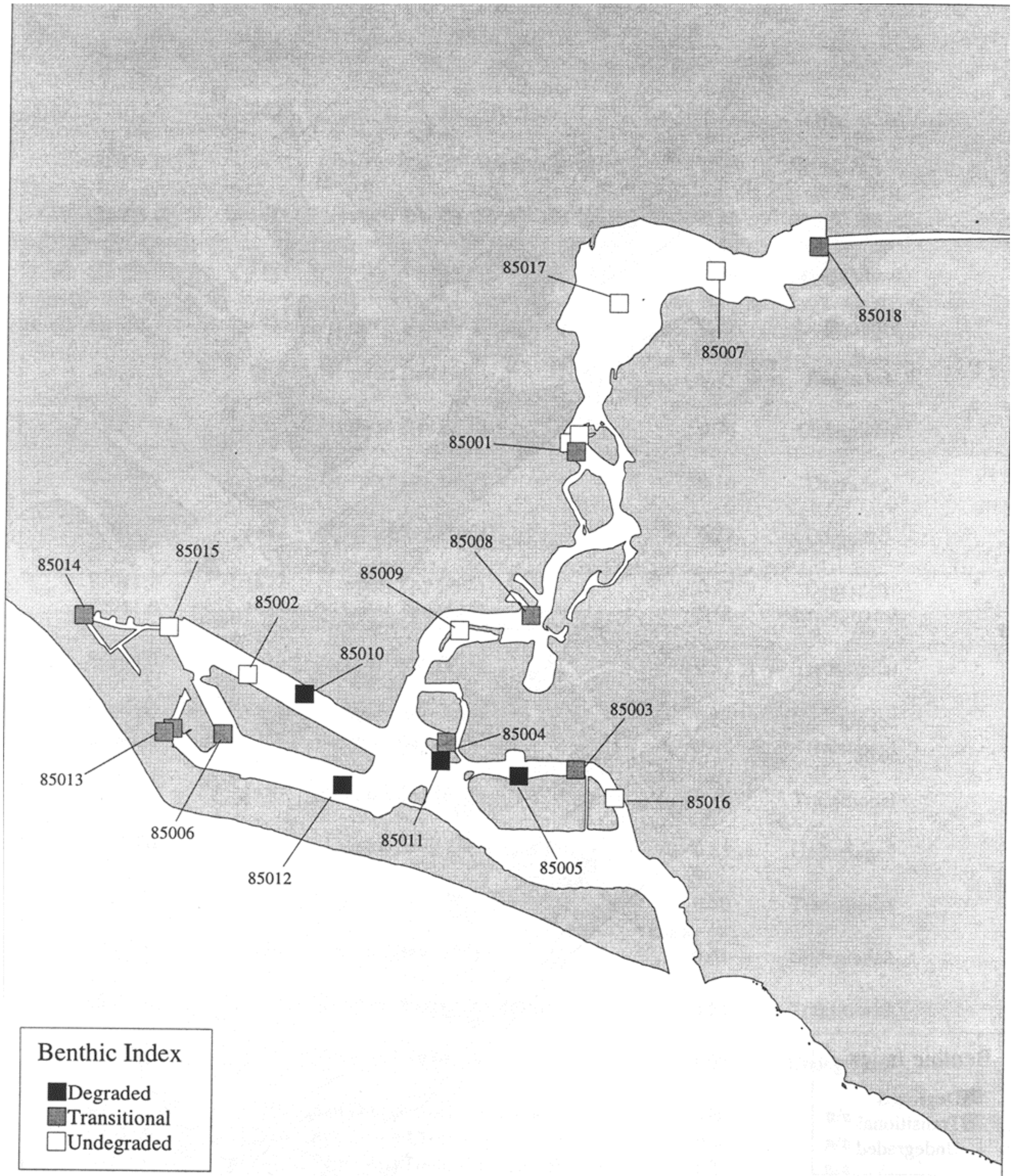

Figure 12: Benthic Index for Stations in Newport Bay

Section 4.3.6 Correlations Among Sediment Chemistry, Toxicity, and Benthic Index Data

The study report describes the results of statistical analyses of the data conducted to evaluate possible relationships among the chemistry, toxicity, and benthic data. Briefly, the authors found a statistically significant relationship between the benthic index and toxicity (to amphipods). These two biological indicators have significant relationships with several metals, chlordane, PCB's and DDT metabolites. Lead, mercury, copper, chromium, nickel, chlordane, and PCB's were correlated with toxicity; copper, chromium, nickel, and DDT metabolites were correlated with reduced benthic index.

Section 4.4 Irvine Ranch Water District Data

On December 18, 1997, April 16, 1998, and October 27, 1998 Irvine Ranch Water District (IRWD) collected samples of San Diego Creek at Campus Drive and Michelson Drive, and analyzed the samples for priority toxic pollutants. Table 15 below lists the monitoring data and summary statistics for dissolved heavy metal concentrations found in San Diego Creek at Campus Drive. The data collected in San Diego Creek at Michelson Drive showed similar results. Concentrations are in parts per billion (ppb). These data show that concentrations of dissolved chromium exceed the acute water quality criterion of 11 ppb (based on a hardness of 400 mg/L). established by the USEPA in the California Toxics Rule for this toxic chemical. Concentrations of dissolved selenium also exceed the CCC of 5 ppb. Therefore, these data show concentrations of dissolved chromium and selenium in the water of San Diego Creek at Campus Drive at levels that are, or could be, adversely affecting aquatic life beneficial uses, in violation, or threatened violation, of the Basin Plan narrative objective.

Table 16 below lists all the organic chemicals that were not detected in San Diego Creek during all three sampling events. The detection limits employed are also shown. These data show that water column monitoring is not sufficient, in itself, to evaluate the impact of the discharges of toxic substances. When compared to the SMW and TSMP tissue concentrations discussed above it can be clearly seen that many toxic substances are not detected in water column monitoring, but are shown to be bioaccumulating in aquatic resources in the Bay. For example, DDT, PCBs, and many pesticides were not detected in the water column by this IRWD monitoring, but are shown by the SMW and TSMP data to be bioaccumulating. This shows that some toxic substances are being discharged at levels below the lowest detection level for methods used to analyze for toxic pollutants in the water column, but are bioaccumulating to levels in fish and mussel tissue that may pose a threat to organisms or public health.

Table 17 below summarizes IRWD's monitoring data for the three monitoring events, for those toxic substances that were detected. Only four chemicals, carbon disulfide, di(2-ethylhexyl)phthalate, Phenolic compounds, tetrachloroethylene, and trichloroethylene, were detected occasionally, and therefore the data does not indicate these chemicals to be a problem. However, the data are not adequate to determine compliance with the CMC and CCC of the California Toxics Rule objectives cited in Section 2. The detection limits for those chemicals that were not detected may also exceed the CTR objectives in some cases so it is impossible to determine compliance.

Table 15: San Diego Creek at Campus Drive, Concentrations of Dissolved Heavy Metals (IRWD, WWSP 1997-99)

Date	Arsenic	Cadmium	Chromium	Copper	Lead	Selenium	Zinc	Mercury
	ppb	ppb	Ppb	ppb	ppb	Ppb	ppb	ppb
12/18/97	4.7	0.3	0.85	29.7	3.25	27.8	14.7	<0.2
1/27/98	0.5	0.23	0.22	12	0.4	22.3	9.61	<.20
2/19/98	6	0.27	8.5	13.7	ND	36.9	3.52	<.20
3/10/98	5.69	0.44	16.2	22	ND	65	4.23	<.20
4/16/98	5.78	0.48	10	21.9	ND	64.6	4.5	<.20
5/21/98	3.88	0.6	4.76	25.8	3.1	23.7	14	0.011
6/16/98	5.48	0.24	3.09	18.5	2.04	38.1	15.3	0.018
7/7/98	5.54	0.34	4.62	28	1.7	40.5	16.7	0.02
8/12/98	10.3	0.363	1.16	4.96	0.58	33.8	12	0.024
9/1/98	4.86	0.258	0.701	15.7	0.24	30.7	3.71	0
10/27/98	9.7	0.172	12	5.12	0.06	43.7	3.81	0
11/18/98	6.91	0.265	9.67	3.15	0.07	49.6	5.58	0.01
12/15/98	5.62	0.322	3.48	2.24	0.03	36.9	19.2	0
1/7/99	5.45	0.203	1.24	2.19	0	37	11.8	0.049
2/23/99	6.15	0.152	5.72	2.44	0.01	42.6	23	0.017
3/30/99	8.53	0.214	14.7	2.55	0.06	52.9	4.98	
Average	5.94	0.30	6.06	13.12	0.89	40.38	10.42	0.01
Maximum	10.30	0.60	16.20	29.70	3.25	65.00	23.00	0.05
Minimum	0.50	0.15	0.22	2.19	0.00	22.30	3.52	0.00
No. of Samples	16.00	16.00	16.00	16.00	13.00	16.00	16.00	10.00

Table 16: ORGANIC CHEMICALS NOT DETECTED BY IRWD MONITORING

Toxic Substance	MDL	Unit	Toxic Substance	MDL	Unit	Toxic Substance	MDL	Unit
1,1,1-Trichloroethane	0.5	ug/l	Benzo(a)pyrene		ug/l	Isophorone		ug/l
1,1,2,2-Tetrachloroethane	0.5	ug/l	Benzo(b)fluoranthene		ug/l	M,p-Xylenes	0.5	ug/l
1,1,2-Trichloroethane (1,1,2-T}	0.5	ug/l	Benzo(g,h,i)perylene		ug/l	m-Dichlorobenzene (1,3-DCB)	0.5	ug/l
1,1-Dichloroethane	0.5	ug/l	Benzo(k)fluoranthene		ug/l	Methoxychlor		ug/l
1,1-Dichloroethylene (1,1DCE)	0.5	ug/l	Benzoic Acid		ug/l	Methyl Bromide	1	ug/l
1,2,4-Trichlorobenzene		ug/l	Benzyl Alcohol		ug/l	Methyl Chloride	1	ug/l
1,2-Dichloroethane	0.5	ug/l	Beta-BHC		ug/l	Methylene Chloride	3	ug/l
1,2-Dichloropropane	0.5	ug/l	bis(2-Chloroethoxy)methane		ug/l	Naphthalene		ug/l
1,2-Diphenylhydrazine		ug/l	bis(2-Chloroethyl)ether		ug/l	Nitrobenzene		ug/l
2,4,5-Trichlorophenol		ug/l	bis(2-Chloroisopropyl)ether		ug/l	N-Nitrosodimethylamine		ug/l
2,4,6-Trichlorophenol		ug/l	Bromoform	0.5	ug/l	N-Nitrosodi-N-propylamine		ug/l
2,4-Dichlorophenol		ug/l	Butylbenzylphthalate		ug/l	N-Nitrosodiphenylamine		ug/l
2,4-Dimethylphenol	5	ug/l	Carbon Tetrachloride	0.5	ug/l	o-Dichlorobenzene (1,2-DCB)		ug/l
2,4-Dinitrophenol		ug/l	Chlordane		ug/l	o-Xylene	0.5	ug/l
2,4-Dinitrotoluene		ug/l	Chlorobenzene	0.5	ug/l	P,p' DDD		ug/l
2,6-Dinitrotoluene		ug/l	Chloroethane	0.5	ug/l	P,p' DDE		ug/l
2-Butanone (MEK)	10	ug/l	Chloroform (Trichloromethane)	0.5	ug/l	P,p' DDT		ug/l
2-Chloroethylvinylether	0.5	ug/l	Chrysene		ug/l	PCB 1016 Aroclor		ug/l
2-Chloronaphthalene		ug/l	cis-1,2-Dichloroethene	0.5	ug/l	PCB 1221 Aroclor		ug/l
2-Chlorophenol		ug/l	cis-1,3-Dichloropropene	0.5	ug/l	PCB 1232 Aroclor		ug/l
2-Hexanone	10	ug/l	Delta-BHC		ug/l	PCB 1242 Aroclor		ug/l
2-Methylnaphthalene		ug/l	Dibenzo(a,h)anthracene		ug/l	PCB 1248 Aroclor		ug/l
2-Methylphenol		ug/l	Dibenzofuran		ug/l	PCB 1254 Aroclor		ug/l
2-Nitroaniline		ug/l	Dibromochloromethane	0.5	ug/l	PCB 1260 Aroclor		ug/l
2-Nitrophenol		ug/l	Dichlorobromomethane	0.5	ug/l	p-Chloro-m-cresol		ug/l
3,3'-Dichlorobenzidine		ug/l	Dichlorodifluoromethane	0.5	ug/l	p-Dichlorobenzene (1,4-DCB)		ug/l
3-Nitroaniline		ug/l	Dieldrin		ug/l	p-Dichlorobenzene (1,4-DCB)	0.5	ug/l
4,6-Dinitro-o-cresol		ug/l	Diethylphthalate		ug/l	Pentachlorophenol		ug/l

Table 16: ORGANIC CHEMICALS NOT DETECTED BY IRWD MONITORING

Toxic Substance	MDL	Unit	Toxic Substance	MDL	Unit	Toxic Substance	MDL	Unit
4-Bromophenylphenylether		ug/l	Dimethylphthalate		ug/l	Phenanthrene		ug/l
4-Chloroaniline		ug/l	Di-n-butylphthalate		ug/l	Phenol		ug/l
4-Chlorophenylphenylether		ug/l	Di-n-octylphthalate		ug/l	Pyrene		ug/l
4-Methyl-2-Pentanone (MIBK)	10	ug/l	Endosulfan I (alpha)		ug/l	Styrene	0.5	ug/l
4-Methylphenol		ug/l	Endosulfan II (beta)		ug/l	Tetrahydrofuran	10	ug/l
4-Nitroaniline		ug/l	Endosulfan sulfate		ug/l	Toluene	0.5	ug/l
4-Nitrophenol		ug/l	Endrin		ug/l	Total Cyanide	0.025	mg/l
Acenaphthene		ug/l	Endrin Aldehyde		ug/l	Toxaphene		ug/l
Acenephthylene		ug/l	Ethyl benzene	0.5	ug/l	Trans-1,2-Dichloroethene	0.5	ug/l
Acetone	10	ug/l	Fluoranthene		ug/l	Trans-1,3-Dichloropropene	0.5	ug/l
Acrolein	200	ug/l	Fluorene		ug/l	Trichlorofluoromethane	0.5	ug/l
Acrylonitrile	50	ug/l	Gamma-BHC		ug/l	Vinyl Acetate	10	ug/l
Aldrin		ug/l	Heptachlor		ug/l	Vinyl Chloride (VC)	0.5	ug/l
Alpha-BHC		ug/l	Heptachlor Epoxide		ug/l			
Aniline		ug/l	Hexachlorobenzene		ug/l			
Anthracene		ug/l	Hexachlorobutadiene		ug/l			
Benzene	0.5	ug/l	Hexachlorocyclopentadiene		ug/l			
Benzidine		ug/l	Hexachloroethane		ug/l			
Benzo(a)anthracene		ug/l	Indeno(1,2,3-c,d)pyrene		ug/l			

Table 17: Organic Chemicals Detected by IRWD Monitoring

ANALYTE	DESCR	LOCCODE	DATE	RESULT	MDL	RSLT	UNIT
Carbon disulfide	SDCCB	B	12/18/97	Not detected	0.5	Not detected	ug/l
Carbon disulfide	SDCCB	B	4/16/98	Not detected	0.5	Not detected	ug/l
Carbon disulfide	SDCCB	B	10/27/98	0.9	0.5	0.9	ug/l
Di(2-Ethylhexyl)phthalate	SDCCB	B	12/18/97	Not detected		Not detected	ug/l
Di(2-Ethylhexyl)phthalate	SDCCB	B	4/16/98	47	4	47	ug/l
Di(2-Ethylhexyl)phthalate	SDCCB	B	10/27/98	Not detected	4	Not detected	ug/l
Phenolic Compounds	SDCCB	B	12/18/97	Not detected	0.01	Not detected	mg/l
Phenolic Compounds	SDCCB	B	4/16/98	<0.010	0.01	<0.010	mg/l
Phenolic Compounds	SDCCB	B	10/27/98	0.011	0.01	0.011	mg/l
Tetrachloroethylene (PCE)	SDCCB	B	12/18/97	0.6	0.5	0.6	ug/l
Tetrachloroethylene (PCE)	SDCCB	B	4/16/98	Not detected	0.5	Not detected	ug/l
Tetrachloroethylene (PCE)	SDCCB	B	10/27/98	Not detected	0.5	Not detected	ug/l
Trichloroethylene (TCE)	SDCCB	B	12/18/97	0.5	0.5	0.5	ug/l
Trichloroethylene (TCE)	SDCCB	B	4/16/98	Not detected	0.5	Not detected	ug/l
Trichloroethylene (TCE)	SDCCB	B	10/27/98	Not detected	0.5	Not detected	ug/l

On two occasions, IRWD also collected water samples from 7 locations throughout Newport Bay, and analyzed the samples for dissolved heavy metals and toxic organic substances. These data showed the organic chemicals were, for the most part, not detected and the concentrations of dissolved metals were well below the CTR objectives, at all 7 locations in the Bay.

Section 4.5 Orange County Stormwater NPDES Permit Monitoring Data

The County of Orange Public Facilities and Resources Department (OCPFRD) acts as lead agency for the agencies implementing the NPDES permit for urban stormwater runoff in the watershed, which includes requirements for monitoring. Stormwater runoff monitoring by OCPFRD has shown (Table 18) that San Diego Creek at Campus Drive has concentrations of dissolved cadmium, chromium, copper, lead and zinc less than the CTR water quality objectives for these substances. Since the dissolved metal concentrations are below the CTR criteria these chemicals are probably not contributing to acute or chronic effects on aquatic life. OCPFRD has also periodically collected water samples from 5 locations throughout Newport Bay, and analyzed the samples for dissolved heavy metals and toxic organic substances. These data showed the organic chemicals were, for the most part, not detected and the concentrations of total metals were below the CTR objectives, at all 5 locations in the Bay.

The data summarized in Table 18 below were collected by OCPFRD at San Diego Creek at Campus Drive from January 1997 to April 1999. The data are mostly from storm events and for dissolved metal concentrations. There has been monitoring conducted at a frequency necessary to determine compliance with the instantaneous maximum CMC objective and the 4 day average CCC objective in the CTR for those metals that are monitored. However, it should be noted that the 4-day average calculation is for each sequential 4 sample days, whether the days are consecutive or not. These 4-day values are therefore 4-sample days, but still provide a 4-day average to compare with the CCC criteria. The OCPFRD stormwater monitoring data shows that concentrations of dissolved cadmium, chromium, copper, lead and zinc in San Diego Creek at Campus Drive have not exceeded the CTR CMCs and CCCs, between January 1997 and April 1999.

Table 18: Summary of OCPFRD Stormwater NPDES Permit Monitoring, San Diego Creek at Campus Drive (OCPFRD, 1991-1998) (CMC values are in ppb of dissolved metals and CCC values are the 4-day average concentrations in ppb.)

DATE	Cd	Cd-4 day	Cr	Cr-4 day	Cu	Cu-4 day	Pb	Pb-4 day	Ni	Ni-4 day	Ag	Ag-4 day	Zn	Zn-4 day	Hardness
	Ppb	ppb	ppb	ppb	ppb	Ppb	ppb	ppb	ppb	ppb	Ppb	ppb	ppb	ppb	mg/L
CTR CMC/CCC@ 275 Hardness	5	16	11	35	21	190	7	1102	122	20		276	278		
CTR CMC/CCC@ 400 Hardness	6	16	11	50	29	281	11	1513	168	37		379	382		
4/7/99	1	1	8	8	18	15	2	2	7	5	2	2	14	13	
Average	1	1	9	9	15	16	3	4	6	8	1	1	36	38	422
Maximum	10	5	75	38	100	55	70	37	73	73	2	2	320	184	576
Minimum	1	1	1	1	5	9	1	1	1	3	1	1	5	8	180
No. of Samples	66	69	68	69	69	69	69	69	67	68	68	69	69	69	4

CMC = Constituent Maximum Concentration (acute objective)
CCC = Constituent Chronic Concentration (chronic objective)

Section 4.6 Orange County CWA Section 319 Contract Monitoring Data

In 1993 the Regional Board commissioned the "Newport Bay Watershed Toxicity Study" (Baily, H.C. et al, UC Davis February 1993). This study collected samples of San Diego Creek at Campus Drive and Culver Drive, and Peters Canyon Wash at Barranca Parkway, and analyzed the samples for acute and chronic toxicity to fathead minnows, ceriodaphnia dubia, and selenastrum algae. The study also included a toxicity identification evaluation (TIE) to identify the causes of the toxicity that was found. This study found that none of the three samples showed significant effects on mortality or growth of the fathead minnows, but found 100% mortality to ceriodaphnia at all three locations. There was no inhibition to algae growth in any of the samples. The TIE portion of the study indicated that heavy metals were probably not causing the toxicity and that pesticides probably were causing at least some of the toxicity.

This study was followed by an intensive investigation of the causes and sources of the acute toxicity found in San Diego Creek. This investigation, which is being completed by the OCPFRD, with G. Fred Lee and Scott Taylor, RBF, is in the final phase before the final report is to be submitted to the Regional Board, in accordance with the terms of the contract that provided funding for a portion of the work under Section 319 of the Clean Water Act.

Briefly, beginning in October 1996 ten locations were sampled for toxicity testing and TIE studies, including San Diego Creek at Campus Drive. Sampling was conducted during both wet and dry weather. Table 19 below provides a summary of the concentrations of diazinon and chlorpyrifos and the levels of acute toxicity to ceriodaphnia found in San Diego Creek at Campus Drive.

As shown, complete mortality in the 4 to 7 day test usually occurred during the first day of the test. Concentrations of diazinon and chlorpyrifos were also present at levels known to cause toxicity to ceriodaphnia and other organisms, based on the risk assessment for these chemicals completed by the manufacturers and/or the California Department of Fish and Game Water Quality Criteria for Diazinon and Chlorpyrifos. (Fish and Game fresh water CMC and CCC for diazinon, are 0.08 ppb and 0.05 ppb, and their CMC and CCC for chlorpyrifos are 0.02 ppb and 0.014 ppb.) TIE studies conducted on the samples show that organophosphate pesticides, diazinon and chlorpyrifos, are causing approximately 50% of the measured toxicity. The study has not been able to conclusively identify the cause of the remaining toxicity, but pyrethroid pesticides are suspected as a possible source. Up to 32 acute toxicity units were measured in the smaller tributaries (these results will be discussed as part of the source analysis).

In general, the toxicity and pesticide monitoring conducted under this contract shows that discharges of pesticides to Hines Channel from two nurseries are a significant source of toxicity and pesticides, and that the toxicity in Hines Channel persists downstream to San Diego Creek at Campus Drive. The toxicity testing also shows that there is toxicity to mysid shrimp (a marine organism), which may indicate a threat to the aquatic life beneficial uses of Newport Bay.

Table 19: Summary of Acute Toxicity and Pesticide Monitoring in San Diego Creek at Campus Drive (OCPFRD, G. Fred Lee and Scott Taylor, RBF, November 1998)

Date	Station	Diazinon	Chlorpyrifos	% Mortality	TUa	Estimated TUa
		Ppb	Ppb	(Days to 100%)		(LC50 to Cerio)
10/30/96	SDC@Campus	0.370	0.157	100(1)	>8	3
11/19/96	SDC@Campus Base	0.164	ND	0	0	0.5
11/21/96	SDC@Campus	0.359	0.133	100(1)		2.5
9/25/97	SDC@Campus	0.155	0.106	100(3)		1.5
11/13/97	SDC@Campus	0.462	0.161	100(1)	4 to 8	3
11/30/97	SDC@Campus	0.226	0.063	100(1)	3 to 4	1
11/30/97	SDC@Campus	0.278	0.090	100(2)		2
12/6/97	SDC@Campus	0.215	0.089	100(2)		1.5
12/6/97	SDC@Campus	0.257	0.057			1
12/6/97	SDC@Campus	0.197	<0.050			<1
12/6/97	SDC@Campus	0.195	0.082			1.5
3/24/98	SDC@Campus Base	0.148	ND	0		0.3
3/25/98	SDC@Campus	0.196	ND	100(4)		0.4
3/25/98	SDC@Campus	0.462	0.050			1.5
3/25/98	SDC@Campus	0.294	ND			0.5
3/26/98	SDC@Campus	0.250	ND			0.5
5/5/98	SDC@Campus	0.136	ND	100(2)		0.3
5/12/98	SDC@Campus	0.096	0.065	100(1)		0.8
5/12/98	SDC@Campus	0.375	0.057	100(1)		1.6
5/13/98	SDC@Campus	0.375	0.057			1.5
5/13/98	SDC@Campus	0.371	0.058			1.5
8/13/98	SDC@Campus Base	0.253	0.067	0		1.3
8/25/98	SDC@Campus Base	0.492	0.011	0		1.2
11/8/98	SDC@Campus	<0.050	0.500	100(1)		6
1/21/99	SDC@Campus Base	0.570	0.070	100(1)	2 to 4	2
1/25/99	SDC@Campus	0.960	<0.050	100(1)		2
1/25/99	SDC@Campus	0.910	<0.050	100(1)		2
1/26/99	SDC@Campus	0.880	<0.50	100(1)	4 to 8	2
1/27/99	SDC@Campus	0.640	0.048	100(1)	4 to 8	1.5

This evidence shows that stormwater and non-storm water runoff being discharged into San Diego Creek contains toxic substances that are highly toxic to aquatic life test organisms. Ceriodaphnia is indicative of similar species that live in San Diego Creek, and the mysids used in the toxicity tests are indicative of the marine organisms that live in Newport Bay. The results indicate that toxic substances, including diazinon and chlorpyrifos, are causing or threatening to cause adverse impacts to the biota of San Diego Creek, in violation of the Basin Plan narrative objective. Modeling is currently being conducted to determine the extent of impact within the Bay resulting from the discharge of various loads of toxic substances, as part of the development of this TMDL. Additional TIE studies need to be conducted to determine the other toxic substances causing toxicity in San Diego Creek at Campus Drive, from San Diego Creek and other tributaries.

Section 4.7 CA Department of Pesticide Regulations Monitoring Data

Table 20 below is a summary of monitoring of San Diego Creek conducted by the California Department of Pesticide Regulations (DPR). DPR conducted the monitoring to assess the impacts of the implementation of Red Imported Fire Ant (RIFA) control requirements by nurseries in the watershed. These requirements include the use of certain pesticides, including chlorpyrifos, to control the RIFA. These samples were collected during non-storm base flow conditions in the creek. This monitoring found acute toxicity to ceriodaphnia in San Diego Creek and indicated that diazinon and chlorpyrifos may be the cause. These data confirm the OCPFRD/RWQCB study discussed above. The levels of toxicity and pesticides found by DPR show violations of the narrative objectives and other criteria. DPR also monitored for Fonofos, Methidathion, M. Parathion, Phosmet, Bifenthrin, Fenoxycarb, Hydramethylnon, and Pyriproxyfen, which were all not detected.

Table 20: Summary of DPR RIFA Monitoring, San Diego Creek at Campus Drive

Date	Acute Toxicity	Acute Toxicity	Chlorpyrifos	Diazinon	Dimethoate	Bifenthrin	Malathion
	% Mortality	% Mortality	ppb	ppb	ppb	ppb	ppb
	(test/control)	(test/control)					
	c. dubia	n. mercedis					
Base							
5/21/99	0/0	25/20	ND	0.159	ND	ND	ND
6/25/99	0/0	30/15	ND	0.13	ND	ND	ND
9/23/99	30/0	50/45	ND	0.134	ND	ND	ND
10/26/99	100/5		0.58	0.16	0.451	ND	ND
12/9/99	100/0		0.124	0.189	0.092	ND	ND
1/17/00	100/0		0.079	0.128	ND	ND	ND
3/27/00	95/5		ND	0.168	ND	ND	ND
4/19/00	100/0		0.062	0.197	0.197	ND	0.071
Average			0.211	0.158	0.247	ND	0.071
Range			ND-0.58	0.128-0.197	0.092-0.451	ND	0.071
Rain							
1/25/00	100/0		0.121	0.591	ND	ND	0.35
1/25/00	100/0		ND	0.836	0.06	ND	0.188
1/25/00	100/5		0.108	0.566	ND	ND	0.395
1/25/00	100/5		0.081	0.542	ND	ND	0.533
1/25/00	100/5		0.163	0.498	ND	ND	1.47
1/25/00	100/10		0.206	0.537	ND	ND	0.251
2/23/00	100/10		0.101	0.135	0.138	ND	0.07
Average			0.130	0.529	0.099	ND	0.465
Range			ND-0.206	0.13-0.83	ND-0.138	ND	0.07-1.47

Table 20: Summary of DPR RIFA Monitoring, San Diego Creek at Campus Drive							
	Methidathion	**M. Parathion**	**Phosmet**	**Fonofos**	**Fenoxycarb**	**Hydramethylnon**	**Pyriproxyfen**
	ppb	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
Base Flow							
5/21/99	ND	ND	ND	ND	ND	ND	ND
6/25/99	ND	ND	ND	ND	ND	ND	ND
9/23/99	ND	ND	ND	ND	ND	ND	ND
10/26/99	ND	ND	ND	ND	ND	ND	ND
12/9/99	ND	ND	ND	ND	ND	ND	ND
1/17/00	ND	ND	ND	ND	ND	ND	ND
3/27/00	ND	ND	ND	ND	ND	ND	ND
4/19/00	ND	ND	ND	0.073	ND	ND	ND
	Methidathion	**M. Parathion**	**Phosmet**	**Fonofos**	**Fenoxycarb**	**Hydramethylnon**	**Pyriproxyfen**
	ppb	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**	**ppb**
Rain							
1/25/00	ND	ND	ND	ND	ND	ND	ND
1/25/00	ND	ND	ND	ND	ND	ND	ND
1/25/00	ND	ND	ND	ND	ND	ND	ND
1/25/00	ND	ND	ND	ND	ND	ND	ND
1/25/00	ND	ND	ND	ND	ND	ND	ND
1/25/00	ND	ND	ND	ND	ND	ND	ND
2/23/00	ND	ND	ND	ND	ND	ND	ND